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ETHEOSTOMA COLOROSUM AND *E. BELLATOR*, TWO NEW DARTERS, SUBGENUS *ULOCENTRA*, FROM SOUTHEASTERN UNITED STATES

ROYAL D. SUTTKUS
Tulane University Museum of Natural History
Belle Chasse, La 70037

AND

REEVE M. BAILEY
Museum of Zoology, The University of Michigan
Ann Arbor, Mi 48109-1079

TYPE SPECIMENS OF FISHES IN THE TULANE UNIVERSITY MUSEUM OF NATURAL HISTORY

HENRY L. BART, JR.

AND

MICHAEL S. TAYLOR
Tulane University Museum of Natural History
Department of Ecology, Evolution, and Organismal Biology
Tulane University, New Orleans, La 70118

TYPE SPECIMENS OF VASCULAR PLANTS AT TULANE UNIVERSITY, WITH A BRIEF HISTORY OF THE TULANE HERBARIUM

ANNE S. BRADBURN

AND

STEVEN P. DARWIN
Department of Ecology, Evolution, and Organismal Biology
Tulane University, New Orleans, LA 70118

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ETHEOSTOMA COLOROSUM AND *E. BELLATOR*, TWO NEW DARTERS, SUBGENUS *ULOCENTRA*, FROM SOUTHEASTERN UNITED STATES

ROYAL D. SUTTKUS
Museum of Natural History, Tulane University
Belle Chasse, LA 70037

REEVE M. BAILEY
Museum of Zoology, The University of Michigan
Ann Arbor, MI 48109-1079

ABSTRACT

Two new darters, subgenus *Ulocentra*, are described from Alabama and western Florida. Both are members of the *Etheostoma duryi* species group with the premaxilla free from the upper lip, and the vomer usually or consistently with one or a few teeth. Both usually have five branchiostegal rays and lack an orange-red band in the anal fin. The coastal darter, *E. colorosum*, is the only species of *Ulocentra* inhabiting the coastal streams of southern Alabama and northwestern Florida between the Perdido and Choctawhatchee rivers. It lacks a red ocellus anteriorly on the first dorsal fin, with red or orange color restricted to the last three to five membranes, and has other characters suggesting close affinity with *E. tallapoosae* and other as yet unnamed *Ulocentra* species from the Gulf Coastal Plain. Nuptial males of *E. colorosum* have a diagnostic series of small red or orange punctulations along the side and additionally have other associated pigment features. It is a slightly smaller species than *E. tallapoosae* and the scales are larger. The Warrior darter, *E. bellator*, is discontinuously distributed in the Black Warrior River system above the Fall Line in Alabama. Nuptial males have a red ocellus in the first membrane of the spinous dorsal fin. There are two series of elongate blotches on the midside separated by a pale area, and the bright orange stripe on the lower side and caudal peduncle is narrow. Two other species of *Ulocentra* also live in the upper Black Warrior system, *E. zonistium* with a characteristically banded first dorsal fin and *E. chermocki*, confined to the Turkey Creek drainage, the latter species most closely related to *E. bellator* but distinguished by different lateral pigmentation and a broad ventrolateral stripe in nuptial males.

INTRODUCTION

Members of *Etheostoma* subgenus *Ulocentra* occur in Gulf Coastal drainages east of the Mississippi River, several eastern tributaries to the lower Mississippi River, the Tennessee and Cumberland river systems, and southern tributaries to the Ohio River. The presence of darters of this subgenus south of the Tennessee River system (Mississippi River drainage) has been known for many years. *Etheostoma coosae* was the first species to be described from the southern zone of the subgenus (Fowler, 1945). Four decades later, Bailey and Etnier (1988) described *E. zonistium*, which is distributed primarily in western, lower tributaries to the Tennessee River but also occurs in a few headwater branches of the Sipsey

Fork of the Black Warrior River system, Alabama. These headwater tributaries are just across the divide from the upper part of Bear Creek, a tributary to the Tennessee River. Suttkus and Etnier (1991) described two more species (*E. tallapoosae* and *E. brevirostrum*) of the subgenus. In early 1992 one of us (R. D. S.) and H. T. Boschung, independently discovered and studied an isolated form of subgenus *Ulocentra* in the Turkey Creek system, a tributary to the Locust Fork of Black Warrior River system, Jefferson Co., Alabama. It was described as *E. chermocki* by Boschung et al. later in 1992. Some of the data compiled by R. D. Suttkus are incorporated in this paper under their name, *Etheostoma chermocki*.

The darters described herein were first recognized many years ago and have become common knowledge. The details of their geographic distributions and their relationships to other close geographical forms, until recently, have remained poorly understood. The subgenus *Ulocentra*, as here interpreted, follows Bouchard (1977) and Bailey and Etnier (1988).

Materials and Methods

Specimens of the new species and comparative material used are primarily from the collections of Academy of Natural Sciences of Philadelphia (ANSP); Auburn University (AUM); Cornell University (CU); Tulane University Museum of Natural History (TU); University of Alabama (UAIC); University of Florida including former Florida State University specimens (UF); University of Michigan Museum of Zoology (UMMZ); National Museum of Natural History (USNM); and University of Tennessee (UT).

Counts and measurements were made as described in Hubbs and Lagler (1958) except as follows. Transverse body scales were counted from the origin of the anal fin diagonally upward to the base of the spinous dorsal fin. Gill rakers, counted on the anterior arch of either the left or the right side, include both dorsal and ventral rudiments. Measurements were made with needle-point dial calipers and recorded to the nearest 0.1 mm. Trans-pelvic width was measured between the outer bases of the pelvic spines. Our measurements of the length of the spinous dorsal, soft dorsal and anal fins are the total lengths of these fins when depressed and not the length of the fin base. Names used for associated fish species follow Robins et al. (1991).

In the listing of type material, each catalog number is followed by the number of specimens examined and the range of standard length (SL) in millimeters, e.g., (10, 27–52). In addition to standard compass directions (with the following "of" deleted), the following abbreviations are used: Cr. = Creek, R. = River, mi = mile(s), airmi = airmile(s), trib. = tributary, Fk. = Fork, hwy = highway, rd = road, Co. = County, T = Township, R = Range, Sec = Section. In lists of materials not designated as types, the catalog number is followed by the number of specimens examined, enclosed in parentheses.

Etheostoma colorosum, new species
Coastal Darter
Figures 1, 8, and 12

Etheostoma simoterum. Gilbert, 1891: 159 (misidentification, Sandy Cr. record). Stevenson, 1976: 37 (in key, characters, orange-sided darter). Mettee, O'Neil, and Harris, 1983: 24, 88 (in part; Hall Cr., Little Escambia Cr., Pollard Oil Field, AL).

Etheostoma sp. Bailey, Winn, and Smith, 1954: 143 (Orangestripe darter, Escambia R. records).

Etheostoma (Ulocentra) sp. Smith-Vaniz, 1968: 136 (in part, reports from Conecuh and Choctawhatchee River systems). Jenkins, 1976 (in part, undescribed species, distribution). Kuehne and Barbour, 1983: 97-98, *pl. 12* (in part, "Gulfcoast Snubnose Darter," characterized, range map in part). Gilbert and Walsh, 1991: 16 ("Gulfcoast snubnose darter," probable source of color illustration in Kuehne and Barbour).

Coastal Plain Darter, *Etheostoma* sp. Page and Burr, 1991: 309 (in part, *pl. 43* [not coastal darter], *map 346*, in part).

HOLOTYPE: Adult male, TU 162508, 50.1 mm standard length (SL), Pine Barren Creek, tributary to Escambia River at Still Road (T5N, R32W, Sec 20), Escambia County, Florida, 29 March 1992, R. D. Suttkus.

PARATOPOTYPES: TU 162509 (47, 34–54), collected with holotype are distributed as follows: TU 162509 (42), UMMZ 221365 (5); TU 152006 (36, 33–50), 22 April 1988, distributed as follows: TU 152006 (32), ANSP 169684 (2), CU 73644 (2); TU 154470 (27, 36–54), 21 March 1989, distributed as follows: TU 154470 (19), UAIC 10506.01 (4), UT 91.4202 (4); TU 157537 (24, 31–45), 3 March 1990, distributed as follows: TU 157537 (18), UF 92633 (4), USNM 324501 (2).

OTHER PARATYPES: TU 151947 (28, 34–51), Pine Barren Creek at Fla Hwy 99 (T5N, R32W, Sec 28), Escambia Co., Florida, 21 April 1988, distributed as follows: TU 151947 (24), UMMZ 221366 (4); and AUM 26759 (1, 47), Pine Barren Creek at Escambia Co. Rd 4, 2.3 mi W Bratt, Escambia Co., Florida.

ADDITIONAL MATERIAL EXAMINED BUT NOT DESIGNATED AS TYPES: **Perdido River drainage, Florida**. ESCAMBIA COUNTY: AUM 26016 (8), Brushy Cr. at Escambia Co. Rd 99, 2 mi W Walnut Hill (T4N, R33W, Sec 4), AUM 26742 (6), and TU 162538 (9).

Escambia River drainage, Florida. ESCAMBIA COUNTY: UF 54776 (2), Prittchett Mill Branch, 3.9 mi S Century at US Hwy 29 at Bluff Springs (T5N, R31W, Sec 24); UF 54817 (1), trib. to Canoe Cr. at Fla Hwy 4, 5.5 mi W junction with US Hwy 29 (T5N, R31W, Sec 8); UF 54835 (4), Canoe Cr. at Fla Hwy 4, 6.1 mi W junction with US Hwy 29 (T5N, R31W, Sec 8); UF 55915 (2), Mitchell Cr., trib. to Escambia R., 0.4 mi N McDavid at US Hwy 29 (T4N, R31W, Sec 10). **Alabama**. ESCAMBIA COUNTY: UMMZ 163552 (3), Big Escambia Cr. at Flomaton (T1N, R8E, Sec 33), TU 16518 (1); AUM 5506 (4), Cedar Cr., 3.9 airmi NE East Brewton (T2N, R10E, Sec 13); AUM 1076 (2), Escambia R. NE Atmore at Interstate Hwy 65 (T2N, R7E, Sec 4); AUM 26780 (4), Burnt Corn Cr. at Ala Hwy 41 N Brewton (T2N, R10E, Sec 20). CONECUH COUNTY: USNM 43494 (3), Sand Cr., 2.8 mi E Evergreen (T6N, R11E, Sec 36); UMMZ 165987 (8), Murder Cr. at Castleberry (T4N, R10E, Sec 24); UMMZ 155519 (6), Bear Cr., trib. to Murder Cr. at US Hwy 31, 2 mi S Castleberry (T4N, R10E, Sec 35); TU 159841 (72), Jordan Cr. at US Hwy 31, 4.9 mi S Fairview (T5N, R10E, Sec 35), and TU 162528 (34); TU 159829 (17), Spring Cr., 2.5 mi NW Centernary Methodist Church (T7N, R10E, Sec 9). BUTLER COUNTY: UMMZ 88738-39 (3), trib. to Persimmon Cr., 1 mi W Greenville at Ala Hwy 10 (T10N, R14E, Sec 22); UMMZ 128770 (1), Hawkins Cr., trib. to Persimmon Cr., 2.9 mi S Greenville (T9N, R14E, Sec 3); USNM 43527 (4), Greenville, AL (T10N, R14E); UMMZ 139155 (20), Rocky Cr., trib. to Persimmon Cr., 1 mi N Georgiana and 2.75 mi S Chapman (T8N, R13E, Sec 13). CRENSHAW COUNTY: TU 2581 (4), trib. to Patsaliga Cr., 20 mi W Luvergne at Ala Hwy 10 (T9N, R18E, Sec 30). PIKE COUNTY: TU 2605 (1), trib. to Indian Cr., trib. to Conecuh R., 8.4 mi W Troy at Ala Hwy 10 (T10N, R19E, Sec 25). COVINGTON COUNTY: AUM 21082 (3), trib. to Blue Cr., trib. to Conecuh R., 8.6 airmi NW Wing (T3N, R14E, Sec 31).

Blackwater River drainage, Florida. SANTA ROSA COUNTY: UF 54713 (22), Big Juniper Cr., 2.0 mi W Munson at Fla Hwy 4 (T4N, R27W, Sec 12), TU 31731 (13), TU 33842 (2), TU 56741 (72), and TU 106620 (12); UF 54781 (13), East Fork Coldwater Cr., 5.7 mi WNW Munson at Fla Hwy 4 (T4N, R27W, Sec 5), and TU 20940 (10); UMMZ 212001 (15), W Branch Juniper Cr., 2.1 mi S Munson, a campground off Hwy 191 (T4N, R27W, Sec 24, SW 1/4); UF 54978 (14), Sweetwater Cr., 1.3 mi E Munson at Fla Hwy 4 (T4N, R26W, Sec 16), UMMZ 163530 and 169783 (16); TU 57082 (116), Bear Cr., trib. to Sweetwater Cr., 1.3 mi E Munson at Fla Hwy 4 (T4N, R26W, Sec 16), TU 151585 (22), TU 154458 (67), TU 157516 (22), TU 157816 (2), and TU 162518 (10); UF 54962 (4), Big Juniper Cr., 5 airmi S Munson (T3N, R27W, Sec 12); UF 58237 (1), Alligator Cr., trib. to Juniper Cr., 6.0 airmi N Harold (T3N, R26W, Sec 30); TU 151591 (4), Big Juniper Cr., 1.0 mi E McLellan (T6N, R26W, Sec 31); TU 151595 (9), Turkey Cr., trib. to Big Juniper Cr., 3.2 mi NW Munson

(T4N, R27W, Sec 2); UF 58223 (2), Pond Cr., 2 mi WSW Milton at US Hwy 90 (T1N, R28W, Sec 9); UMMZ 165103 (6), Pond Cr., 3.9 mi W Milton along Fla Hwy 10 (T1N, R29W, Sec 1); UF 58196 (1), Pond Cr., 9.8 airmi NW Milton (T3N, R29W, Sec 33); TU 88877 (4), Pond Cr., 7.0 mi NW Milton at Fla Hwy 191 (T2N, R29W, Sec 15), TU 92033 (7), TU 94767 (11), TU 98571 (10), TU 100739 (4), TU 103115 (11), TU 105584 (16), TU 111392 (2), TU 116023 (5), TU 117581 (4), TU 120137 (3), and TU 124295 (2); UF 58351 (2), Blackwater R., 7.0 airmi NE Milton, 0.5 mi NE mouth Coldwater Cr. (T2N, R27W, Sec 16); TU 20524 (7), West Fork Big Coldwater Cr., 3.9 mi E Jay at Fla Hwy 4 (T5N, R29W, Sec 14); TU 27399 (9), Manning Cr., trib. to West Fork Big Coldwater Cr., 14 mi N Milton at Fla Hwy 87 (T3N, R28W, Sec 4); TU 152863 (7), West Fork Big Coldwater Cr. at Fla Hwy 87, 11.8 mi N Milton (T3N, R28W, Sec 10). OKALOOSA COUNTY: UF 54982 (1), Beaver Cr., trib. to Blackwater R., 5.4 mi E Munson at Fla Hwy 4 (T4N, R25W, Sec 18); UF 54838 (3), Blackwater R. at Fla Hwy 4, 4.5 mi NW Baker (T4N, R25W, Sec 22), and TU 23682 (6); UF 56182 (2), Narrows Cr., trib. to Panther Cr., 1.7 mi W Cannontown, about 10 airmi NW Crestview (T4N, R25W, Sec 12). **Alabama**. ESCAMBIA COUNTY: AUM 25995 (1), Blackwater R. at Escambia Co. Rd 4, 1 mi E Bradley (T1N, R13E, Sec 25), and AUM 26728 (2).

Yellow River drainage, Florida. OKALOOSA COUNTY: TU 3719 (17), Big Horse Cr., trib. to Yellow R., 2.7 mi E Blackman (T5N, R24W, Sec 24); TU 3151 (3), Horsehead Cr., trib. to Yellow R., 2.9 mi E Fla Hwy 85 at Fla Hwy 2 (T5N, R22W, Sec 15); UF 54992 (7), Silver Cr., 5.0 airmi SE Crestview (T2N, R23W, Sec 2), and UF 54738 (11); UF 54754 (4), Turkey Gobbler Cr., 8.2 airmi SW Crestview (T2N, R24W, Sec 17); UF 56167 (1), Gum Springs Cr., 3.5 mi N Milligan (T4N, R24W, Sec 34); UF 55832 (1), Silver Cr. public lake drainage, 7 mi N Crestview (T4N, R24W, Sec 24); UF 57156 (5), Turkey Hen Cr., 6.5 mi S Crestview (T2N. R23W, Sec 8), and UF 54733 (3); TU 24085 (21), Laird Mill Cr., 100 yds. before entering Shoal R. (T3N, R22W, Sec 1); TU 24695 (4), trib. to Shoal R. from westside, 0.2 mi below railroad trestle (T3N, R23W, Sec 23); TU 24076 (3), Shoal R. cutoff, 6 mi upriver from Fla Hwy 85 bridge (T3N, R23W, Sec 35); TU 24653 (4), Yellow R. at mouth of nameless creek (T4N, R24W, Sec 35); TU 24647 (3), Horse Cr. at entrance to Yellow R. (T5N, R23W, Sec 29); TU 72819 (5), Yellow R., 4.6 mi W Fla Hwy 85 at Fla Hwy 2 (T5N, R23W, Sec 20), TU 82630 (6), TU 79807 (5), and TU 79701 (2); TU 80486 (4), Yellow R., 0.2 mi downriver from Fla Hwy 2 (T5N, R23W, Sec 20); TU 83099 (1), Yellow R., 3.5 mi SW Crestview at US Hwy 90 (T3N, R24W, Sec 15), TU 101923 (2), and TU 102315 (2); TU 81258 (4), Yellow R. at end of Fla Hwy 189, 2.9 mi S Holt (T2N, R25W, Sec 16); TU 80536 (1), Mill Cr., trib. to Yellow R., 1.1 mi N Milligan (T3N, R24W, Sec 15); TU 81660 (1), Horsehead Cr., trib. to Pond Cr., 3.2 mi SE Laurel Hill (T5N, R22W, Sec 15); AUM 14934 (3), Yellow R. between Oak Grove and Milligan (T4N, R24W, Sec 24); TU 102333 (3), Pond Cr., trib. to Shoal R., 1.0 mi NE Dorcos, Okaloosa Co. Rd 373 (T4N, R22W, Sec 26). WALTON COUNTY: TU 1749 (24), Pine Log Cr., 9.1 mi E Fla Hwy 85 at Fla Hwy 2 (T5N, R21W, Sec 28), and TU 82525 (2); UF 54362 (9), Pine Log Cr., 6.4 mi S Clear Springs (T4N, R21W, Sec 5); UF 54206 (17), Shoal R. at Fla Hwy 285, 4.3 mi S Stella (T4N, R21W, Sec 36), TU 111466 (4), UF 56066 (26), TU 46112 (8), UF 57297 (7), TU 113873 (4), and TU 129426 (4); TU 46398 (1), Turkey Cr., trib. to Shoal R., 1 mi W junction Fla Hwy 2A an US Hwy 331 (T4N, R20W, Sec 16), TU 46454 (3), and TU 67413 (2); UF 54134 (3), Long Cr., 10.3 mi S Clear Springs (T4N, R21W, Sec 21); UF 56225 (3), Big Swamp Cr. at US Hwy 331 at Liberty, 9.5 airmi NW De Funiak Springs (T4N, R20W, Sec 26); TU 24101 (2), Bottle Branch, trib. to Shoal R. (T3N, R21W, Sec 4); TU 24766 (4), Wolf Cr., trib. to Shoal R. (T3N, R21W, Sec 6). **Alabama**. COVINGTON COUNTY: TU 72895 (17), Yellow R. at Covington Co. Rd 4, 12 mi W Florala (T1N, R15E, Sec 34); TU 72974 (38), Yellow R., 9.4 mi NNW Florala, Covington Co. Rd 55 (T2N, R16E, Sec 34); TU 73017 (25), Five Runs Cr., trib. to Yellow R., 15 mi NW Florala (T2N, R15E, Sec 26); TU 73180 (5), Yellow R., 7 mi N Babbie (T5N, R17E, Sec 27); TU 73162 (12), Yellow R., 10 mi SW Opp (T3N, R17E, Sec 21); TU 82612 (3), Yellow R., 4.6 mi SE Wing at Covington Co. Rd 4 (T1N, R15E, Sec 34).

Choctawhatchee River drainage,. Florida. WALTON COUNTY: UF 54149 (2), Eight Mile Cr., 2.7 mi WNW Gaskin (T6N, R19W, Sec 31); UF 54228 (3), Natural Bridge Cr. at Natural Bridge, 4.5 mi WNW Gaskin (T6N, R20W, Sec 26). HOLMES COUNTY: TU 182 (2), Parrot Cr., trib. to Choctawhatchee R., 4.7 mi SSW Geneva, AL (T6N, R17W, Sec 25); TU 1587 (20), Mill Cr., trib. to Choctawhatchee R. at southern limits of Ponce de Leon (T3N, R17W, Sec 28); TU 2285 (4), Wrights Cr., 3.5 mi NW junction Fla Hwy 79 and Fla Hwy 177 at Hwy 177 (T4N, R15W, Sec 1), TU 45652 (1), and TU 46130 (3); TU 46268 (1), Wrights Cr., trib. to Choctawhatchee R., 6 mi S junction Fla Hwy 2 and Fla Hwy 79 at Hwy 79 (T5N, R14W, Sec 32), TU 46434 (6), and TU 46663 (1); UF 54128 (2), Wrights Cr., 6.1 mi W Graceville railroad station at Fla Hwy 2 (T7N, R14W, Sec 35), UMMZ 166309 (1); TU 2475 (3), Little Cr., trib. to Ten Mile Cr., 6.5 mi NNW junction Fla Hwy 79 and Fla Hwy 177 (T5N, R15W, Sec 27); UF 51645 (1), Ten Mile Cr., 7.0 mi NNE Bonifay at Fla Hwy 177 (T6N, R15W, Sec 35); UF 54409 (2), East Pittman Cr., 0.8 mi N Pittman (T5N, R16W, Sec 11). HOLMES-WASHINGTON COUNTY: UF 51250 (3), Holmes Cr., 4.6 mi W Chipley at US Hwy 90 (T4N, R14W, Sec 2). WASHINGTON COUNTY: UF 57945 (2), trib. to Holmes Cr., 6 airmi SW Chipley

at Washington Co. Hwy 280 (T4N, R14W, Sec 22). **Alabama**. GENEVA COUNTY: TU 2418 (2), Spring Cr., trib. to Choctawhatchee R., 1.8 mi N Black (T1N, R23E, Sec 27), and TU 16374 (10); TU 2516 (5), Panther Cr., trib. to Little Choctawhatchee R., 3 mi W Pinckard Farm Rd and US Hwy 84 (T3N, R25E, Sec 7). DALE COUNTY: AUM 27121 (2), Claybank Cr. at Ala Hwy 27 (T5N, R25E, Sec 2).

DIAGNOSIS: *Etheostoma colorosum* is a member of subgenus *Ulocentra* as diagnosed by Bouchard (1977) and Bailey and Etnier (1988). Further, *E. colorosum* lacks a premaxillary frenum and in this respect is typical of members of the *E. duryi* species group of Bailey and Etnier (1988). The vomer is feebly toothed or may lack teeth. *Etheostoma colorosum* lacks a red ocellus in the first membrane of the spinous dorsal fin, as do a few other *Ulocentra* species from the Gulf Coastal Plain. The unique diagnostic feature of *E. colorosum* is a series of small orange to red spots or punctulations along the side of the nuptial male. This series of punctulations extends from base of caudal anteriorly to above pectoral fin base and is immediately dorsal to the mid-lateral brown blotches that are usually centered on the lateral line. Most nuptial males have a few additional orange or red punctulations along the lateral line between the lateral blotches. The lateral blotches are of moderate size and are ovoid to quadrate in shape. The red coloration in the spinous dorsal fin is restricted to the posterior three to five interradial membranes and thus does not form a complete band across the fin. An incomplete band of black blotches extends from the first to the sixth or the seventh or eighth interradial membrane. The posterior black blotches occur on the fin proximally to the anteriormost red blotches. Both the spinous and the soft dorsal fins are noticeably elevated.

DESCRIPTION: *Etheostoma colorosum* reaches a maximum of 48 mm SL (females) to 58 mm SL (males). Sexual dimorphism and apparent sexual maturity occur at the end of the first year at a minimum of 28 mm SL (females) and 30 mm SL (males).

Frequency distributions of scale and fin ray counts are presented in Tables 1 and 2. Number of vertebrae, branchiostegal rays, gill rakers, and preoperculomandibular pores are given in Table 3. The lateral line is usually complete with (39–) 41–47 (–50) scales, occasionally the last scale is unpored. Transverse scales 10 (1 specimen), 11(48), 12(158), 13(158), 14(75), 15(18), or 16(4). Transverse scales from origin of second dorsal fin to anal fin (an alternative count, see Bailey and Etnier 1988: 30) 9(1), 10(11), 11(65), 12(30), 13(5); mean of 112 counts, 11.2. Caudal peduncle scale rows number 12(2), 13(11), 14(79), 15(274), 16(147), 17(50), or 18(6) in 569 specimens. Dorsal fin has (9–) 10–11 (–12) spines and (10–) 11–12 (–13) soft rays. Anal fin has 2 spines and (6–) 7–8 (–9), modally 7, soft rays. Pectoral fin has (13–) 14–15 (– 16) rays. Branchiostegal rays number 4—5(2), 5—5 (534), 5—6 (12), 6—5 (5), or 6—6 (6) in 559 specimens; vertebrae number 37(5), 38(104), 39(104), or 40(6), and gill rakers on first arch number 6(9), 7(53), 8(36), or 9(2). Number of vertebrae (Bailey and Gosline, 1955) and gill rakers are quite consistent within species groups. The sum of left and right preoperculomandibular pores is nearly constant at 18 (in 180 of 190 specimens), the remaining ten have 16, 17, or 19 pores. The opercle, cheek, nape, and prepectoral area typically are covered with exposed scales. The scales on the cheek usually are smaller than those on the opercle, and frequently there is a mixture of exposed and embedded scales. The belly varies from being completely covered with exposed scales to being naked on the anterior half. Females more frequently than males have the anterior part of the belly naked and in some of

TABLE 1. Frequency distribution of scale counts in *Etheostoma colorosum*, *E. bellator*, and *E. chermocki*.

Species and drainage	Lateral-line scales 39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	N	x̄	S.D.
Etheostoma colorosum																				
Perdido R.			2	4	8	2	5	1	1									23	43.5	1.6
Escambia R		4	16	29	47	50	37	23	6	3	2							217	43.8	1.7
Blackwater R.	1	4	14	22	26	34	15	12	8	2								138	43.5	1.8
Yellow R.		1	3	8	12	26	24	25	11	9	3	2						124	45.0	1.9
Choctawhatchee R.	1	-	2	3	15	8	15	9	7	10	4							74	45.1	2.1
Etheostoma bellator																				
Mulberry Fork			2	-	1	3	15	32	33	40	47	26	8	5	1			213	47.9	1.9
Valley Cr.					1	1	3	8	17	12	17	15	14	5	4	2	1	100	49.0	2.3
Etheostoma chermocki																				
Turkey Cr.					4	5	3	12	17	6	11	7	3	2	-	1		71	47.4	2.3

	Scales around caudal peduncle 12	13	14	15	16	17	18	19	20	21	N	x̄	S.D.	Transverse scale rows 10	11	12	13	14	15	16	N	x̄	S.D.
Etheostoma colorosum																							
Perdido R.			6	10	5	1	1				23	15.2	1.0		6	8	7	2			23	12.2	0.9
Escambia R.	1	5	37	112	52	6					213	15.1	0.8		20	67	54	13	2		156	12.4	0.9
Blackwater R.	1	6	27	84	16	2					136	14.8	0.7	1	17	42	28	11	1		100	12.3	0.9
Yellow R.			6	43	48	24	2				123	15.8	0.8		5	18	49	30	6	2	110	13.2	1.0
Choctawhatchee R.			3	25	26	17	3				74	15.9	0.9			23	20	19	9	2	73	13.3	1.1
Etheostoma bellator																							
Mulberry Fork				3	13	114	44	38	1	1	214	17.5	0.9			3	27	60	38	12	140	14.2	0.9
Valley Cr.				1	6	55	21	17			100	17.5	0.9				15	46	35	4	100	14.3	0.8
Etheostoma chermocki																							
Turkey Cr.					8	30	20	10	2	1	71	17.6	1.0				2	45	20	4	71	14.4	0.6

TABLE 2. Frequency distribution of fin ray counts in *Etheostoma colorosum*, *E. bellator*, and *E. chermocki*.

Species and drainage	Dorsal spines 9	10	11	12	N	x̄	S.D.	Dorsal soft rays 9	10	11	12	13	N	x̄	S.D.
Etheostoma colorosum															
Perdido R.	3	14	6		23	10.1	0.6			11	11	1	23	11.6	0.6
Escambia R.	4	129	80	2	215	10.3	0.8		39	104	70	2	215	11.2	0.7
Blackwater R.		38	95	5	138	10.8	0.5		1	55	80	2	138	11.6	0.5
Yellow R.	6	53	63	2	124	10.5	0.6			43	78	3	124	11.7	0.5
Choctawhatchee R.	1	40	32	1	74	10.4	0.5		2	45	26	1	74	11.3	0.5
Etheostoma bellator															
Mulberry Fork	13	101	47		161	10.2	0.5		12	121	28		161	11.1	0.4
Valley Cr.		44	56		100	10.6	0.5	1	10	72	17		100	11.0	0.5
Etheostoma chermocki															
Turkey Cr.		21	47	3	71	10.7	0.5		11	52	8		71	10.9	0.5

Species and drainage	Anal soft rays 5	6	7	8	9	N	x̄	S.D.	Left pectoral rays 13	14	15	16	N	x̄	S.D.
Etheostoma colorosum															
Perdido R.			18	5		23	7.2	0.4			15	8	23	14.3	0.5
Escambia R.		10	148	36		194	7.1	0.4		7	133	74	214	14.3	0.5
Blackwater R.		2	66	70		138	7.5	0.5			44	91	3	138	14.7	0.5
Yellow R.			68	52	4	124	7.5	0.5			46	77	1	124	14.6	0.4
Choctawhatchee R.			47	27		74	7.4	0.4			40	33	1	74	14.5	0.5
Etheostoma bellator															
Mulberry Fork		40	117	4		161	6.8	0.4		15	168	33		216*	14.1	0.4
Valley Cr.		11	75	14		100	7.0	0.5		39	61			100	13.6	0.5
Etheostoma chermocki															
Turkey Cr.	1	4	47	19		71	7.2	0.6		27	44			71	13.6	0.5

*one of 217 specimens with 9 pectoral rays

TABLE 3. Frequency distribution of numbers of vertebrae, branchiostegal rays, gill rakers, and preoperculomandibular pores in *Etheostoma colorosum*, *E. bellator*, and *E. chermocki*.

Species and drainage	Vertebrae 37	38	39	40	N	x̄	S.D.	Branchiostegal rays 4–5	5–5	5–6	6–5	6–6	N
Etheostoma colorosum													
Perdido R.					0				22	1			23
Escambia R.	1	4			5	37.8	0.4	1	194	3	1	1	200
Blackwater R.	1	39	51	4	95	38.6	0.5		135	1	1	1	138
Yellow R.		47	50	2	99	38.5	0.5		113	5	2	4	124
Choctawhatchee R.	3	14	3		20	38.0	0.5	1	70	2	1		74
TOTAL					219	38.5	0.5						559
Etheostoma bellator													
Mulberry Fork	1	54	8		63				190	1	5	6	202
Valley Cr.		3	1		4				100				100
TOTAL					67	38.1	0.4						302
Etheostoma chermocki													
Turkey Cr.		19	4		23	38.2	0.4		71				71

Species and drainage	Gill rakers 6	7	8	9	10	N	x̄	S.D.	Preoperculomandibular pores 16	17	18	19	N	x̄	S.D.
Etheostoma colorosum															
Escambia R.		5	4	1		10	6.6	0.6	1	3	54		58	17.9	0.3
Blackwater R.	6	32	17			55	7.2	0.6		2	84	1	87	17.9	0.1
Yellow R.	1	7	7			15	7.4	0.6		1	33		34	17.9	0.1
Choctawhatchee	2	9	8	1		20	7.4	0.6		2	9		11	17.7	0.4
TOTAL						100	7.3	0.7					190	17.9	0.2
Etheostoma bellator															
Mulberry Fork		6	27	20	2	55	8.3	0.7		5	124	3	132	17.9	0.2
Valley Cr.			8	7		15	8.5	0.5							
TOTAL						70	8.3	0.7							
Etheostoma chermocki															
Turkey Cr.			2	8		10	8.8	0.4		1	9		10	17.9	0.3

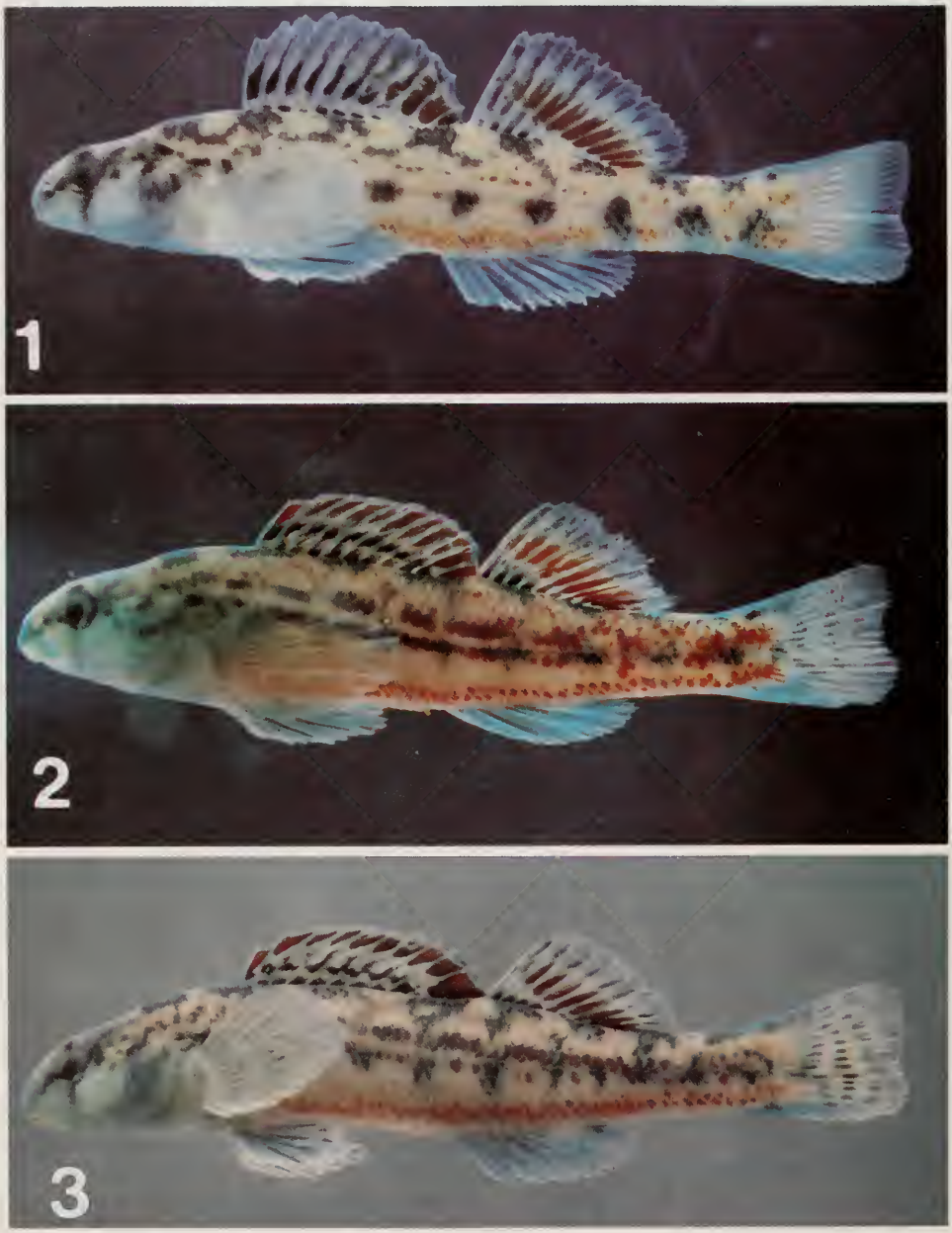
these individuals the scales diminish in size anteriorly and may be partially embedded. The breast is consistently scaleless.

In 10 specimens dissected, the vomer is toothless in four, has a single weak tooth in four, and has two small teeth in two; the palatines are uniformly toothless.

Proportional measurements appear in Tables 4 and 5. Twenty of the 25 males were nuptial specimens taken between the 2nd and the 21st of March. The remainder of the specimens came from a November collection. The two lots of five each of females were taken from a March 21 and an April 8 collection.

Colors of live and freshly preserved nuptial specimens, collected in March and April, are described from Pine Barren Creek of the Escambia R. drainage (Figure 1) and Bear, Sweetwater, and Big Juniper creeks of the Blackwater R. drainage. Nuptial males have an orange stripe on the lower side. This orange stripe usually narrows posteriorly and is partially obliterated by an overlay of turquoise color immediately ventral to the last three lateral blotches. The turquoise extends from the ventral edge of a lateral blotch on one side of the body to the ventral edge of the corresponding blotch on the opposite side. The lateral body blotches are dark brown, oval to rounded quadrate in shape and number seven to nine. These blotches are centered along the lateral line or quite frequently extend farther below the lateral line than above it. One of the diagnostic color features of *Etheostoma colorosum* is the "string" of orange to red-orange small spots that extends along the side above the brown lateral blotches. This series of spots or punctulations extends from the base of the caudal fin anteriorly to the shoulder region just above the base of the pectoral fin. The spots are arranged in linear groups of two to four (or five) closely spaced spots, and the groups are separated by somewhat wider interspaces. Most nuptial males have additional orange spots along the lateral line between the brown lateral blotches. The number of spots between the blotches is usually one or two, or occasionally three. There are some irregularly shaped brown blotches (more linear than the lateral blotches) on the dorsal-lateral area of the body. The upper edges of some of these are connected with the median dorsal blotches (typically eight in number). The blotch on the nape, and the dorsal blotches 7 and 8 on the caudal peduncle, are overlaid with turquoise color. The top of the head is dark brown. The ventral surface of the head from the breast to the anterior tip is pale with an overlay of turquoise color. The entire breast, gill membranes, lower part of opercle, cheek, and side of snout are turquoise in color. There is a dark brown preorbital bar, a dark brown suborbital bar, and several brown blotches along upper margin of the opercle. The iris is dark with a golden edging around pupil.

The pectoral fins are the only ones that lack turquoise in the nuptial male. The pelvic fins and all the median fins have some turquoise coloration. The pectoral fins appear to be clear to the unaided eye, however, magnification reveals considerable dark pigmentation along the rays and that only the interradial membranes are clear. Nearly the entire anal and pelvic fins are turquoise. The tips of the spines and soft rays of anal and pelvic fins are milky white. After the blue color has faded, both the fin rays and the interradial membranes are found to be densely pigmented with melanophores. The margins of the caudal, first and second dorsal fins are turquoise. Some males at the peak of nuptial coloration have more than half the caudal fin turquoise. There are two orange to red-orange blotches at the base of the caudal fin and, immediately posterior, a small central pale area. The rest of the caudal fin is turquoise with the more intense coloration along lower and upper procurrent margins. The marginal and submarginal areas of the spinous dorsal fin are turquoise. Proximally from



Figures 1—3. *Etheostoma* species from Alabama and Florida. 1. *E. colorosum*, TU 162508, holotype, adult male, 50 mm SL. Pine Barren Cr., trib. to Escambia R., Escambia Co., FL (photo by R. D. Suttkus). 2. *E. bellator*, TU 151837, paratype, adult male, 43 mm SL. Murphy Cr. along US Hwy 31, 2.0 mi SW Blount Springs, Blount Co., AL (photo by J. M. Pierson). 3. *E. bellator*, TU 163053, paratype, adult male, 48 mm SL. Murphy and Mill Cr. confluence, 1 mi SW Blount Springs, Blount Co., AL (photo by R. D. Suttkus).

Figures 4—7. *Etheostoma* species from Alabama. 4. *E. bellator*, TU 163053, paratype, adult male, 46 mm SL. Murphy and Mill Cr. confluence, 1 mi SW Blount Springs, Blount Co., AL. 5. *E. bellator*, TU 163017, adult male, 39 mm SL. Fivemile Cr. at McCalla, Jefferson Co., AL. 6. *E. chermocki*, TU 163026, adult male, 57 mm SL. Trib. to Turkey Cr. near Ala Hwy 79, 1 mi N Pinson, Jefferson Co., AL, 28 April 1992. 7. *E. chermocki*, TU 163045, adult male, 48 mm SL. Turkey Cr. at Ala Hwy 75, 1 mi N Pinson, Jefferson Co., AL, 28 April 1992. Photos by R. D. Suttkus.

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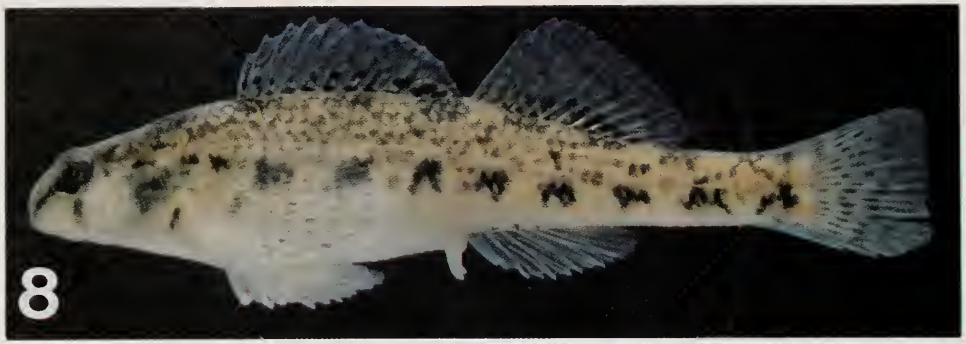
TABLE 4. Measurements in thousandths of standard length for *Etheostoma colorosum*, *E. bellator*, and *E. chermocki* males.

	E. colorosum (N = 25)			*E. bellator* (N = 25)			*E. chermocki* (N = 8)		
	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.
Standard length (mm)	40.6—53.5	47.9	3.5	43.3—57.8	49.0	3.9	40.8—56.4	43.3	5.8
Head length	242—272	257	8.3	246—278	259	8.3	237—264	255	8.1
Body depth at dorsal origin	177—224	194	9.8	191—241	219	12.8	206—234	221	10.2
Snout length	66—81	73	3.3	66—78	72	3.2	64—72	68	2.8
Orbit length	63—75	68	2.8	60—73	66	3.4	55—65	62	3.1
Spinous dorsal fin length	273—319	300	12.3	287—327	309	12.1	286—333	313	15.5
Longest dorsal spine	133—182	154	11.1	116—149	127	8.0	131—156	142	9.9
Soft dorsal fin length	281—338	308	16.1	252—320	276	14.7	253—303	276	16.0
Longest dorsal soft ray	150—191	166	10.9	137—178	154	8.7	150—177	163	8.9
Caudal peduncle length	291—317	305	7.2	270—313	290	10.8	264—279	270	5.4
Caudal peduncle depth	92—112	98	5.0	105—128	114	4.9	108—120	112	4.0
Anal fin length	264—307	280	10.5	231—280	260	12.8	257—281	269	7.8
First anal spine length	50—91	72	8.5	68—97	82	7.3	76—91	84	5.3
Longest anal soft ray	134—168	146	8.0	131—160	148	8.0	135—166	148	9.1
Caudal fin length	210—245	228	9.6	183—230	213	8.7	206—242	225	12.7
Pectoral fin length	260—343	290	18.7	247—298	273	15.5	251—287	271	12.3
Pelvic fin length	200—250	221	11.6	195—242	221	12.5	198—231	216	11.8
Trans-pelvic width	77—93	84	4.1	78—90	83	3.1	75—86	81	3.5
Maximum body width	123—156	137	7.2	122—159	141	10.3	124—143	133	7.0
Interorbital width	39—50	44	2.7	43—55	49	3.0	46—51	47	1.8

TABLE 5. Measurements in thousandths of standard length for *Etheostoma colorosum*, *E. bellator*, and *E. chermocki* females.

	E. colorosum (N = 10)			*E. bellator* (N = 10)			*E. chermocki* (N = 10)		
	Range	$\bar{x}$	S.D.	Range	$\bar{x}$	S.D.	Range	$\bar{x}$	S.D.
Standard length (mm)	38.6—47.1	43.4	2.5	41.9—46.9	43.8	1.5	42.1—49.0	46.2	2.3
Head length	238—267	255	9.3	245—270	258	7.3	235—268	246	9.7
Body depth at dorsal origin	181—224	199	16.6	221—261	241	14.4	228—269	241	13.6
Snout length	63—76	71	3.6	67—74	70	2.2	59—69	62	3.5
Orbit length	71—83	74	3.7	67—76	71	2.7	61—69	65	2.5
Spinous dorsal fin length	265—302	280	12.6	268—311	286	12.8	285—310	297	6.9
Longest dorsal spine	107—130	116	6.9	96—120	108	7.8	103—131	119	8.3
Soft dorsal fin length	269—307	286	11.8	245—266	256	7.3	256—288	270	10.3
Longest dorsal soft ray	142—158	151	5.1	131—153	141	9.2	137—158	147	6.7
Caudal peduncle length	280—314	293	10.0	264—290	279	8.8	263—294	276	8.1
Caudal peduncle depth	84—101	91	6.0	103—118	108	4.5	96—112	106	4.2
Anal fin length	232—272	248	13.6	231—260	247	9.0	233—265	248	9.5
First anal spine length	54—68	60	4.2	65—86	76	7.1	59—91	72	9.6
Longest anal soft ray	116—140	128	8.1	136—152	143	4.8	120—149	138	9.5
Caudal fin length	213—241	222	9.6	201—224	213	8.1	211—240	222	9.0
Pectoral fin length	261—331	294	18.6	255—300	279	13.3	244—317	284	18.6
Pelvic fin length	197—242	209	13.1	196—226	213	9.8	192—222	204	10.9
Trans-pelvic width	77—83	80	2.1	77—85	81	2.5	74—83	78	2.8
Maximum body width	130—159	143	8.8	164—205	180	13.4	145—229	168	24.9
Interorbital width	39—47	44	2.6	47—57	51	2.6	38—50	43	3.4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the turquoise there are two distinct patterns of color. Posteriorly in the mid-portion of the fin there is a series of red blotches that cover most of the interradial membranous areas in the posterior part of the fin but diminish abruptly in size in the successive membranes anteriorly. The number of red blotches varies from three to six; each is margined or haloed with mixtures of white, cream or yellow. The other pattern of color is a series or row of black blotches that extend from the first interradial membrane to the seventh or eighth. These black blotches occur in the basal half of each interradial membrane. There is a slight distal arching of the blotches. Small nuptial males usually have fewer black blotches. The anterior blotch is typically well developed whereas the posterior ones are diminished in size and intensity of pigmentation. The posterior one or two black blotches are proximal to the anterior one or two red blotches (Figure 1). Proximal to the lower ends of the black blotches there is a pale area and beneath that is a series of small black blotches at the base of the fin. These small blotches also are centered on the interradial membranes.

The second dorsal fin has a moderately broad margin of turquoise. Across the middle of the fin is a diagonal band of red color that tapers in width at either end. The red blotches that form the band are located on the interradial membranes. The red band quite frequently does not extend anteriorly to the first or anteriormost interradial area. The next more proximal series (black blotches) is greatly reduced in comparison to that described for the spinous dorsal. The series in the second dorsal is reduced to two to four black blotches. The posterior one to three black blotches are immediately proximal to the anteriormost red blotches described above. There are a few small black blotches at the base of the fin that are similar to those described for the spinous dorsal. The black blotches and the melanophores underlying the turquoise, red, and orange-colored areas remain distinct for a long time in preservative, long after the turquoise, red, and orange coloration has faded.

Nuptial females have some bright coloration although greatly reduced in coverage compared to the nuptial male. The red blotches in the central posterior part of the spinous dorsal are small and number three or four. There are four to six small faint red blotches in a diagonal band across the second dorsal fin. There are a few orange flecks and spots on the body but these spots are scattered and do not form a continuous series as described for the nuptial males. The lower of the two basal caudal orange blotches is present in some females. The spinous rays in the first dorsal and the soft rays in the second dorsal fin are checkered with golden and dusky coloration. There are three or four golden spots along each soft ray. The golden areas alternate with dusky areas along the rays producing a checkered pattern. There is also a row of golden spots, each of which is centered on the interradial membrane along the base of the spinous dorsal fin. The blotches on the upper part of the body, on the top of the head and on the dorsum of the body are pale to medium brown. Those on the upper side are pale brown whereas most of the dorsal blotches are medium brown. The lateral blotches (usually eight) are dark brown and are centered below the

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Figures 8—11. *Etheostoma* species from Alabama and Florida. 8. *E. colorosum*, TU 162509, paratype, adult female, 44 mm SL. Pine Barren Cr. at Still Road, Escambia Co., FL. 9. *E. bellator*, TU 163053, paratype, adult female, 43 mm SL. Murphy and Mill Cr. confluence, 1 mi SW Blount Springs, Blount Co., AL. 10. *E. bellator*, TU 163017, adult female, 37 mm SL. Fivemile Cr. at McCalla, Jefferson Co., AL. 11. *E. chermocki*, TU 163027, adult female, 48 mm SL. Trib. to Turkey Cr. near Ala Hwy 79, 1 mi N Pinson, Jefferson Co., AL, 28 April 1992. Photos by R. D. Suttkus.

lateral line. Most of the ventral lateral area below the lateral blotches is immaculate, except for a few scattered flecks of color. The pectoral and caudal fin rays have dusky and pale areas along their lengths and collectively the dusky areas form wavy vertical bars. There is some yellow along the rays of pectoral, pelvic, and caudal fins. There is a faint wash of turquoise on the anal fin and along upper and lower procurrent margins of the caudal fin. There is a brown prepectoral blotch, a brown suborbital and preorbital bar, and these brown blotches contrast with the pale ventral parts of the head and breast.

DISTRIBUTION: *Etheostoma colorosum* is confined to the coastal drainages of southern Alabama and the western part of the panhandle of Florida (Figure 12). One site is known in the Perdido River drainage and numerous sites to the east in the Escambia R., Blackwater R., Yellow R., and Choctawhatchee R. drainages. The species is not known to occur in the tidal areas around the heads of Perdido, Escambia, Blackwater, and Choctawhatchee Bays. Kuehne and Barbour's (1983) distribution map (page 97) of the "Gulfcoast Snubnose Darter" includes additional species in the Alabama and Tombigbee River drainages, and Page and Burr's (1991) map for their "Coastal Plain Darter" also represents a complex of species and does not include the Choctawhatchee River drainage (see page 302, map 346). Page's (1983) plate 16G of the "Coastal Plain darter" and Page and Burr's (1991) plate 43, bottom, of the "Coastal Plain Darter" are not referable to *Etheostoma colorosum*. No other species of subgenus *Ulocentra* occurs within the range of *E. colorosum*.

HABITAT AND BIOLOGY: In general the description of the habitat by Kuehne and Barbour (1983) for the "Gulfcoast Snubnose Darter" and that by Page and Burr (1991) for the "Coastal Plain Darter" apply to the habitat of *E. colorosum*. In addition to the sand and gravel substrates mentioned by the above authors, there are a few sections of hard clay, limestone, or sandstone in the Blackwater River drainage of Florida and in the upper reaches of the Escambia and Yellow River dainages in Alabama that apparently serve as suitable habitats, especially where there are some nearby patches of sand or gravel or rooted aquatic plants.

Based on recent collections, spawning occurs from early March to late April. Some late April collections indicated the near end to spawning or included a mixture of spent and nearspent individuals. The sex ratio is skewed toward more females. Based on five collections of types (holotype, four series of paratopotypes, and one series of paratypes from Pine Cr. at Fla. Hwy 99) taken over several years (1988-1992) in March and April, the 163 specimens include 58 (35.6%) males and 105 (64.4%) females. In one collection of 116 specimens taken on 8 March 1969 from Bear Cr., trib. to Sweetwater Cr. (Blackwater R. drainage) there are 47 (40.5%) males versus 69 (59.5%) females. The 58 males in the five type series range from 33.7 to 54.2 mm SL with a mean of 43.7 mm; the 105 females in the same five series range from 31.2 to 48.1 mm, mean 39.1 mm. The 47 males in the series from Bear Cr. range from 30.1 to 53.2 mm, mean 39.1 mm; the 69 females from 28.2 to 40.4 mm, mean 34.2 mm.

The species associates of *Etheostoma colorosum* at the Still Rd and at the Fla Hwy 99 sites in the five collections of types, are as follows: *Ichthyomyzon gagei, Erimyzon tenuis, Minytrema melanops, Moxostoma poecilurum, Cyprinella venusta, Notemigonus crysoleucas, Notropis buccatus, N. hypselopterus, N. signipinnis, N. texanus, N. welaka, Opsopoeodus emiliae, Semotilus thoreauianus, Noturus leptacanthus, Fundulus*

olivaceus, Gambusia holbrooki, Aphredoderus sayanus, Ambloplites ariommus, Lepomis macrochirus, L. megalotis, L. punctatus, Micropterus salmoides, Etheostoma davisoni, E. edwini, and *Percina nigrofasciata.*

VARIATION: Counts of lateral-line scales, scales around caudal peduncle, and transverse scale rows average higher in the Yellow and Choctawhatchee River drainages than in the three drainages to the west (Table 1). Variation in fin-ray counts is considerably less than in scale counts. Fin-ray counts are slightly higher in the three eastern drainages (Blackwater, Yellow, and Choctawhatchee) than in the Perdido and Escambia River drainages (Table 2).

COMPARISONS: *Etheostoma colorosum* males differ notably from *E. bellator* males in that they lack a red ocellus in the first membrane of the spinous dorsal fin; red coloration is restricted to the last few membranes in the spinous dorsal fin whereas the red forms a submarginal band across the entire fin in *E. bellator. Etheostoma colorosum* males (Figure 1) have an incomplete series of black blotches covering the lower one-third to one-half of the anterior membranes of the spinous dorsal fin whereas *E. bellator* males have a more complete narrow band of black across the lower part of the fin (Figures 2-5).

Etheostoma colorosum has lower scale counts (lateral-line, scales around caudal peduncle, transverse scale rows), and lower gill raker counts than does *E. bellator* (Tables 1, 3).

In general *E. colorosum* is more slender than *E. bellator.* This body shape is best shown by comparison of body depth versus body length and caudal peduncle depth versus caudal peduncle length. Also *E. colorosum* has longer soft dorsal, caudal, and pectoral fins in both sexes than does *E. bellator* (Tables 4, 5), but the anal fin is appreciably longer only in males. The spinous and soft dorsal fins are higher in *E. colorosum* than in *E. bellator* in males and females, but the first anal spine in *E. bellator* is longer than that of *E. colorosum* in both sexes.

Based on the similarity of the coloration of the spinous dorsal fin of males, *Etheostoma colorosum* is more similar to *E. tallapoosae* than to any other described member of subgenus *Ulocentra.* Both species lack a red ocellus in the first membrane and both have the red coloration restricted to the posterior membranes (Figure 1; Suttkus and Etnier, 1991: Figure 1). The red coloration is more extensive in *E. tallapoosae* than in *E. colorosum* and this red coloration shades into brown anteriorly. Together the red and the brown form a broad, more or less pronounced band, whereas in *E. colorosum* the red coloration ends abruptly and is replaced in part by black blotches that extend distally in each of the anterior membranes (Figure 1). The small orange to red spots or punctulations described in the diagnosis are unique to *E. colorosum.* The lateral blotches are smaller in *E. colorosum* than in *E. tallapoosae.*

There are some differences in the morphometrics of the two species. Based on 25 males of each species, the soft dorsal fin length and the longest dorsal soft ray show no overlap (Table 6). Proportional measurements of soft dorsal fin length are 281–338 ($\bar{x}$ = 308) in *E. colorosum* and 242–276 ($\bar{x}$ = 260) in *E. tallapoosae.* Measurements of longest dorsal soft ray are 150–191 ($\bar{x}$ = 166) in *E. colorosum* and 114–146 ($\bar{x}$ = 134) in *E. tallapoosae.* In addition, *E. colorosum* has longer caudal, pectoral, and anal fins; the longest dorsal spine and longest anal soft ray average is greater in *E. colorosum* than in *E. tallapoosae* (Table 6). Thus, the fins are longer and more elevated in *E. colorosum* than in *E. tallapoosae.*

ETYMOLOGY: The name *colorosum*, a Latin adjective in neuter form, is from *color*, color, and *-osus*, denoting usually fullness or abundance of, in reference to the high color especially of nuptial males. We recommend the vernacular name coastal darter in allusion to the coastwise distribution.

Etheostoma bellator, new species
Warrior Darter
Figures 2-5, 9-10, 13

Etheostoma (Ulocentra) sp. Smith-Vaniz, 1968: 136 (Black Warrior R.). Dycus and Howell, 1974: 23, 27 (Black Warrior R. system records). Jenkins, 1976 (undescribed species, distribution). Warrior darter. Page, 1983: *pl. 16C, 16D*. Page and Burr, 1991: 303, *pl. 43, map 346*.
Etheostoma sp. B. Mettee, 1978: 149 (habitat, distribution). Mettee, et al. 1989a: 71-76, 189, map (distribution, species associates, habitat). Mettee, et al. 1989b: 153 (distribution).
Etheostoma sp. Warrior snubnose darter. Boschung, et al. 1992: *fig. 1, C* and *D*; 15-20 (morphometric data, counts, descriptive comparisons, localities).

HOLOTYPE: Adult male, TU 162448, 44.0 mm standard length, Murphy Creek along US Hwy 31, 2.0 miles SW Blount Springs (T13S, R3W, Sec 14), Mulberry Fork to Black Warrior River system; Blount County, Alabama, 17 April 1988, R. D. Suttkus, M. F. Mettee, P. E. O'Neil, and J. M. Pierson.

PARATOPOTYPES: TU 151837 (76, 25–49), collected with holotype are distributed as follows: TU 151837 (70), UMMZ 221367 (6); TU 162671 (4, 34–43), Murphy Cr. along US Hwy 31, 1.6 mi SW Blount Springs (T13S, R3W, Sec 11), 9 April 1992, Blount Co., AL; TU 62656 (73, 23–58), Murphy Cr. at confluence with Mill Cr. along US Hwy 31, 1 mi SW Blount Springs (T13S, R3W, Sec 12), 19 December 1969, TU 77091 (179, 27–54), 4 April 1972, distributed as follows: TU 77091 (155), ANSP 169685 (2), CU 73645 (2), UAIC 10507.01 (4), UF 92634 (4), UMMZ 221368 (4), USNM 324502 (4), and UT 91.4203 (4); TU 89606 (89, 21–52), 5 August 1974; TU 125438 (13, 31–44), 15 May 1982; TU 151827 (175, 27–51), 17 April 1988; TU 162665 (2, 32 and 36), 9 April 1992; and TU 163053 (21, 30–48), 29 April 1992.

OTHER PARATYPES: UMMZ 88848-49 (44, 19–42), Blount Springs Cr., along US Hwy 31, 10 mi N Warrior, trib. to Mulberry Fk., Blount Co., AL; UMMZ 168582 (2, 33 and 36), trib. to Mulberry Fk., 5 mi SW Blountsville (T11N, R1W, Sec ca. 32), Blount Co., AL; UMMZ 168592 (1, 26), trib. to Mulberry Fk., 2 mi N Blountsville (T11N, R1W, Sec 12), Blount Co., AL; UMMZ 177736 (30, 27–46), trib. to Blount Springs Cr., S Blount Springs (T13N, R24, Sec ca. 18), Blount Co., AL; USNM 166360 (32, 21–48), and USNM 166003 (27, 27–42), trib. to Mulberry Fk., along US Hwy 31, about 9 mi N Warrior, Blount Co., AL; and USNM 36736 (8, 32–47), Blount Springs, Blount Co., AL.

ADDITIONAL MATERIAL EXAMINED BUT NOT DESIGNATED AS TYPES: **Black Warrior River system, Alabama.** JEFFERSON COUNTY: TU 62670 (4), trib. to Valley Cr., 4.7 mi SW Bessemer at US Hwy 11 (T19S, R5W, Sec 36); TU 127804 (2), Fivemile Cr., trib. to Valley Cr. at McCalla (T19S, R5W, Sec 36), TU 140953 (7), TU 140976 (9), TU 162681 (42), TU 163017 (49), TU 163187 (9); TU 61944 (8), Gurley Cr. at Ala Hwy 79, 7.7 mi N Pinson (T14S, R1W, Sec 30). WINSTON COUNTY: UMMZ 168565 (2), W Fork Sipsey Fk., 6 mi E Double Springs (T10N, R6W, Sec 30). LAWRENCE COUNTY: TU 163061 (1), Borden Cr. at forest road (T8S, R8W, Sec 28). BLOUNT COUNTY: UMMZ 158288 (2), west flowing trib. to Locust Fk., 3 mi NNE Oneonta, Hwy 32 (T12N, R2E, Sec 9).

DIAGNOSIS: *Etheostoma bellator* is a member of the subgenus *Ulocentra* as defined by Bouchard (1977) and Bailey and Etnier (1988). Further, *E. bellator* lacks a premaxillary frenum and has vomerine teeth and in these respects is typical of members of the *E. duryi* species group of Bailey and Etnier (1988). *Etheostoma bellator* has a red ocellus in the first membrane of the spinous dorsal fin in adult males. Moreover, most females of both the Murphy Cr. and Fivemile Cr. populations have a red ocellus and a complete red, submarginal band in the spinous dorsal fin. In addition, the nuptial males display two distinctive color patterns. There are two series of more or less elongate blotches along the mid-lateral area of the body and these are separated by a pale area, particularly on the anterior half of the body. The other pattern is the narrowness of the bright orange stripe along the lower side.

DESCRIPTION: *Etheostoma bellator* reaches a maximum of 47 mm SL (females) to 58 mm SL (males). Sexual dimorphism and apparent sexual maturity occur at the end of the first year at a minimum of 25 mm SL (females) and 27 mm SL ((males). A few of the small males did not have fully developed nuptial color patterns such as were displayed by others of the same size.

Frequency distributions of scale and fin ray counts are presented in Tables 1 and 2. Number of vertebrae, branchiostegal rays, gill rakers and preoperculomandibular pores are presented in Table 3. The lateral line is usually complete with (41–) 45–51 (–55) scales. Occasionally the last scale is unpored. Transverse scales number 12 (3 specimens), 13 (42), 14 (106), 15 (73), or 16 (16). Transverse scales from origin of second dorsal fin to anal fin (an alternative count, see Bailey and Etnier, 1988: 30) 11(3), 12(20), 13(46), 14(8); mean of 77 counts, 12.8. Caudal peduncle scale rows number 15 (4), 16 (19), 17 (169), 18 (65), 19 (55), 20 (1), or 21 (1). The dorsal fin has (9–) 10–11 spines and (9–) 10–12 soft rays. The anal fin has 2 spines and 6–7 (–8), modally 7, soft rays. The pectoral fin has 13–15 rays. Branchiostegal rays number 5—5 (290), 5—6 (1), 6—5 (5), 6—6 (6) in 302 specimens; vertebrae number 37 (1), 38 (57), or 39 (9) and gill rakers on first arch number 7 (6), 8 (35), 9 (27), or 10 (2). The sum of left and right preoperculomandibular pores is nearly constant at 18 (in 124 of 132 specimens), the remaining eight have 17 or 19 pores. Typically the cheek, opercle, and nape are covered with exposed scales. Occasionally the opercle is not completely covered and also there may be a mixture of exposed and embedded scales. Infrequently there is a small median naked area on the nape just behind the occiput. The scales on the cheek are usually smaller than those on the opercle and frequently some are embedded. The prepectoral area ranges from being naked to completely covered with scales. The breast is usually naked but occasionally has one or a few scales, and the belly is completely covered with exposed scales.

All 10 specimens examined for dentition have a small cluster of one to four or five, usually two or three, teeth on the head of the vomer; there are no palatine teeth.

Proportional measurements appear in Tables 4 and 5. Eighteen of the 25 males were nuptial specimens taken between 4 April and 17 April. The two lots of five each of females were collected on 4 April 1972 and 17 April 1988.

Colors of live and freshly preserved nuptial specimens, collected in April during different years, are described from Murphy Cr. and Fivemile Cr. specimens (Figures 2-5, 9-10). During the height of the breeding time the nuptial male is brightly colored with turquoise on snout, lips, preorbital area, cheek,

TABLE 6. Measurements in thousandths of standard length for *Etheostoma colorosum* and *E. tallapoosae* males.

	E. colorosum (N = 25)			*E. tallapoosae* (N = 25)		
	Range	$\bar{x}$	S.D.	Range	$\bar{x}$	S.D.
Standard length (mm)	40.6—53.5	47.9	3.5	43.2—61.2	48.8	3.8
Head length	242—272	257	8.3	236—262	249	8.1
Body depth at dorsal origin	177—224	194	9.8	191—220	203	8.6
Snout length	66—81	73	3.3	66—79	72	4.0
Orbit length	63—75	68	2.8	57—67	63	2.6
Spinous dorsal fin length	273—319	300	12.3	265—308	290	10.6
Longest dorsal spine	133—182	154	11.1	99—142	120	10.9
Soft dorsal fin length	281—338	308	16.1	242—276	260	9.3
Longest dorsal soft ray	150—191	166	10.9	114—146	134	7.7
Caudal peduncle length	291—317	305	7.2	293—328	310	9.0
Caudal peduncle depth	92—112	98	5.0	99—113	106	3.7
Anal fin length	264—307	280	10.5	227—276	246	11.4
First anal spine length	50—91	72	8.5	61—76	66	3.7
Longest anal soft ray	134—168	146	8.0	111—144	129	7.8
Caudal fin length	210—245	228	9.6	176—216	202	10.9
Pectoral fin length	260—343	290	18.7	221—271	250	14.3
Pelvic fin length	200—250	221	11.6	194—245	220	10.6
Trans-pelvic width	77—93	84	4.1	74—87	82	2.7
Maximum body width	123—156	137	7.2	126—164	142	7.4
Interorbital width	39—50	44	2.7	41—48	44	1.9

opercle, gular area, breast, prepectoral area, and top of head. The anterior two median dorsal saddle blotches and the two posterior ones on the caudal peduncle are dark turquoise as are the upper and lower procurrent margins of the caudal fin, the entire anal fin, the pelvic fins except for a pearly white marginal fringe, a narrow marginal fringe on the spinous dorsal and a broad marginal band on the soft dorsal fin. The spinous dorsal fin has a bright red ocellus in the first membrane that is followed by red blotches of less intensity in the succeeding membranes. All together these red blotches form a submarginal band across the entire fin. Proximal to the red band is a narrow, pale, cream-colored band (with yellowish fringe) across the fin and proximal to that is a narrow band of small black blotches. Another cream-colored band is immediately proximal to the black band. The median-dorsal saddle blotches seemingly have extensions of pigment onto the adjoining membranes of the fin. The soft-rayed dorsal fin has a broad marginal band of turquoise that is separated from the broad median band of red by a narrow, cream-colored area and, as described for the spinous dorsal, there is another cream-colored area proximal to the red band. There are extensions of black pigment onto the membranes of the fin at the two median-dorsal saddle blotches at the base of the fin. The lower half of the pectoral fin is nearly clear whereas the upper part has cream to yellow pigment along the rays.

The two series of more or less elongate blotches along the mid-lateral area of the body are bright orange or red posteriorly and russet anteriorly. The lower series is aligned along the lower margin of the lateral-line. The upper series is more or less fused with the lower series at its posterior extremity on the caudal peduncle but is noticeably separated from the lower series in its anterior half by a pale area. The two series of elongate blotches plus the cream- to pale rose-colored intermediate areas tend to obliterate the underlying brown lateral blotches.

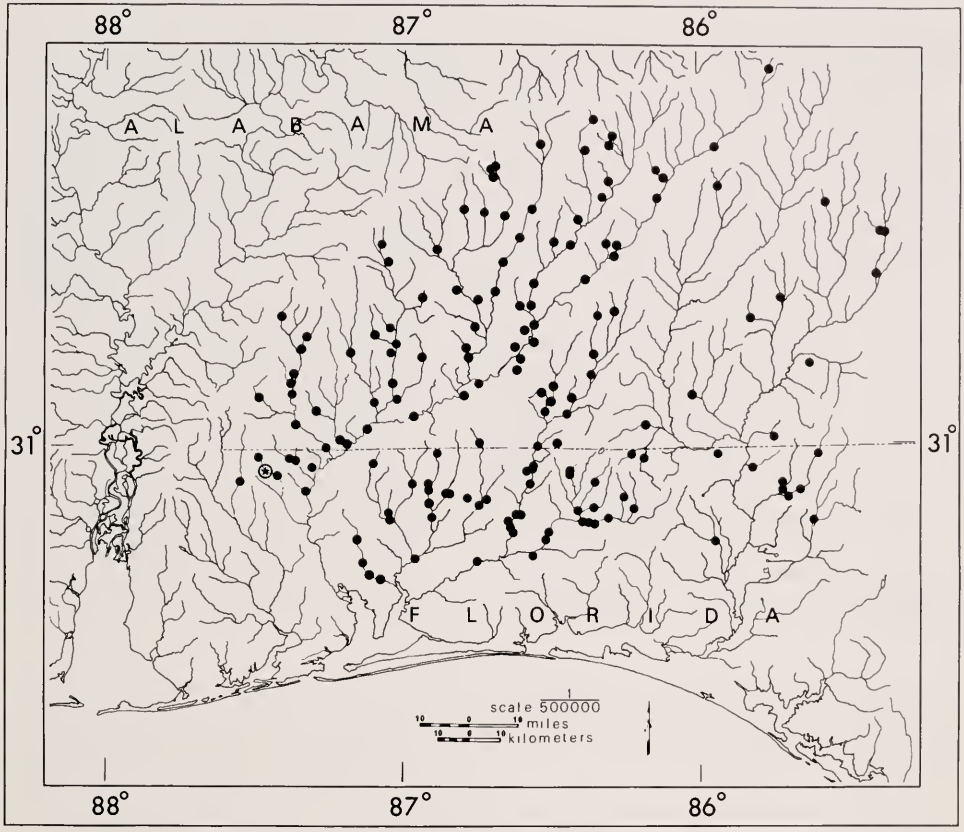

Figure 12. Distribution of *Etheostoma colorosum* (solid circles; type locality solid star in open circle).

During the winter when the bright nuptial colors have faded, the brown lateral blotches (quadrate or diamond-shape) are more pronounced and usually extend somewhat below the lateral-line. Nuptial males have a narrow orange stripe along the lower side. This orange stripe is separated from the lower ends of the brown lateral blotches. The double series of more or less elongate blotches separated by a pale area and a narrow stripe versus a broad band of orange along the lower side are diagnostic characters of *E. bellator*.

Nuptial females from both Murphy Creek and Fivemile Creek (Valley Creek system) populations have a submarginal red band in the spinous dorsal fin (Figures 9 and 10). Similar to the nuptial male, the anterior blotch (ocellus) is bright red whereas the blotches in the remainder of the band are subdued. Females of both populations exhibit some small flecks of chromatic color on the body. In addition, many Murphy Creek females have a red band across the middle of the second dorsal fin. This band is reduced in size and intensity of pigmentation in comparison to the respective red band in the nuptial male.

DISTRIBUTION: *Etheostoma bellator* is confined to the Black Warrior River system of northcentral Alabama (Figure 13). There are several disjunct populations. Our description is based on the Murphy Creek and the Valley Creek populations.

HABITAT AND BIOLOGY: *Etheostoma bellator* inhabits bedrock pools and raceways, rubble-strewn pools and fast water, riffles and moving water over gravel-filled depressions in bedrock pools of small to medium streams.

Based on collections made between 1972 and 1992, spawning extends from March through mid-May with the peak occurring in April. Four collections of types (all nuptial specimens) from Murphy Creek and five collections of nuptial specimens from Fivemile Creek (trib. to Valley Cr.) were analyzed for sex ratio, size range, and average size of nuptial specimens: a collection made on 4 April 1972 has 68 males and 110 females; another made on 17 April 1988 has 60 males and 114 females; a second collection made on 17 April 1988 has 39 males and 38 females; and a collection made on 29 April 1992 has 11 males and 10 females. The total for the four collections of types from Murphy Creek is 450 specimens, 178 males (39.5%) versus 272 females (60.4%). The males ranged in SL from 26.8 to 53.8 mm, mean 36.6 mm; the females ranged from 25.4 to 46.9 mm, mean 34.6 mm. The five collections from Fivemile Creek total 116 specimens; 44 males (37.9%) versus 72 females (62.1%). Males range from 32.9 to 54.1 mm SL, mean 39.6 mm, the females from 31.0 to 45.3 mm, mean 36.6 mm.

The species associates of *E. bellator* at the type locality area (Murphy and Mill Creeks) are as follows: *Hypentelium etowanum, Campostoma* sp., *Cyprinella callistia, C. venusta, Notropis asperifrons, Semotilus atromaculatus, Fundulus olivaceus, Lepomis cyanellus, L. macrochirus, L. microlophus, Micropterus coosae, M. salmoides, Etheostoma whipplei, Percina nigrofasciata,* and *Cottus carolinae.*

VARIATION: There are no dramatic differences in scale or fin-ray counts between the Murphy Creek and Valley Creek populations and there is no consistency in the slight differences that could be attributed directly to a north-south cline. The Valley Creek population, the more southern location, has a slightly higher lateral-line scale count, about the same transverse scale row and caudal peduncle scale counts, slightly higher dorsal spine count, about the same dorsal soft ray count, higher anal soft ray count, but a somewhat lower pectoral fin-ray count. The red band in the spinous dorsal and in the soft dorsal of some Murphy Creek males is wider than any observed in Valley Creek specimens. Females of both populations have a red band in the spinous dorsal fin, but only Murphy Creek females were observed to have a red band in the soft dorsal fin (Figures 9-11); samples from the two populations were not compared morphometrically and so the absence of discussion on this aspect does not automatically imply that the two populations are similar or alike in this respect.

COMPARISONS: *Etheostoma bellator* is more similar to *E. chermocki*, a recently described species (Boschung, Mayden, and Tomelleri, 1992), than to *E. zonistium* (Bailey and Etnier, 1988). All three species are inhabitants of the middle or upper portions of the Black Warrior River system, above the Fall Line. We could not confirm all statements made by Boschung et al. (1992) in their diagnosis of *E. chermocki* and their comparisons of *E. chermocki* and the 'Warrior darter' [= *bellator*]; we suspect this is because they did not fully appreciate the amount of variation in color intensity and pattern that is correlated with size of nuptial males of *E. chermocki* and the amount of variation in color pattern in both nuptial males and females of *E. bellator* (Figures 2-7, 9-11). We preface our remarks by noting that we have no color slides, prints, or recent color notes for nuptial males from Gurley Creek, the upper part of Sipsey Fork, or from the extreme

upper part of either the Mulberry or the Locust Fork. Our comparisons are based on recent color photos and color notes, recorded at time of collection, for *E. chermocki* from Turkey Creek and of *E. bellator* from Murphy Creek and Valley Creek populations.

A tabular comparison of salient characteristics of nuptial males of *E. bellator* and *E. chermocki* is presented in Table 7. We consider our specimen (Figure 6) and other males of about 55 mm or greater in SL to be in the larger male category for *E. chermocki*; our specimen (Figure 7) and the Boschung et al. (1992) specimen (Figure 1, A, male, illustrated by painting), to be in the smaller male category.

The red band in the spinous dorsal of nuptial males of the two species is distinctly different, but not always in the details illustrated and discussed by Boschung et al. (1992). Our observations indicate that the near-basal black band in the spinous dorsal fin is quite similar in width in the two species. We agree that the red band in the soft-rayed dorsal fin is typically broader in *E. chermocki* than in *E. bellator*, but find no significant differences in coloration of caudal, anal, and pectoral fins (in their diagnosis), nor are any portrayed in their Figures 1, A and C. Two statements in their diagnosis are perplexing: "The vermilion-colored venter extends dorsally and is *adjacent to* [emphasis added] lateral band;" and "Lateral blotches and brick-red coloration are *separated from* [emphasis added] the ventral vermilion coloration by straw-colored halos." None of our specimens, small or large, had straw-colored halos separating the red color of the ventral-lateral body area from the ventral margins of the lateral blotches. None of the females of *E. chermocki* in our collections taken with nuptial males had any chromatic coloration in the spinous dorsal such as displayed by female *E. bellator* from Murphy and Fivemile Creeks (Figures 9-11). Also, most females of *E. chermocki* had jet-black pigmentation in the posterior membrane of the spinous dorsal fin. A few *E. bellator* females from Fivemile Creek had a dusky posterior membrane.

Boschung et al. (1992: 13) stated that the nape is naked in *E. chermocki* whereas our observations reveal that most specimens have the nape completely covered with scales; a rare specimen has a narrow patch of naked skin immediately behind the occiput. Our gill raker counts range from 7 to 10 whereas they give a range of 5 to 7.

Comparison of data for *E. chermocki* and *E. bellator* males (Table 4) shows slight differences in the majority of the proportions, however, there are a few morphometrics that show moderate average differences: longest dorsal spine, longest dorsal soft ray, caudal peduncle length, and caudal fin length. Thus, in consideration of the four morphometrics there is a range in absolute separation from 15.8% to a maximum of 69.5%. In terms of overlap, the minimum is 30.5% to the maximum of 84.2% overlap.

Etheostoma bellator differs from *E. zonistium* in having fewer bands of color across the spinous dorsal fin and in having a narrow rather than broad stripe of orange or red on the lower side. The stripe of orange is well separated from the lateral-band pigmentation whereas in nuptial male *E. zonistium* the entire lower side is red, from the lower margin of the lateral stripe to the venter.

STATUS OF HABITAT: Mill Creek just above its confluence with Murphy Creek is being modified by a residential development. One of the initial steps of the project was to raise the height of the low dam on Mill Creek. The developer seems to be making an effort to retain some of the natural beauty of the area;

during a visit to the area in spring of 1992 there was no evidence of siltation below the dam. Fivemile Creek is moderately impacted by the residences in and around the town of McCalla. The continued maintenance of bridges and small roads, as well as an Interstate Highway that crosses the stream in the vicinity of McCalla, periodically contributes to disturbance of the stream bed and its banks.

ETYMOLOGY: The name *bellator*, Latin masculine noun, a warrior, is for the Black Warrior River drainage system to which the species is confined. We use the common name Warrior darter, following precedent of others who have referred to the species.

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A list of all individuals who contributed toward the collecting of study material during the last five decades would be nearly endless. The following is a partial list of those who helped collect a few to many series: Marian K. Bailey, James M. Barkuloo, Henry L. Bart, Jr., William L. Brudon, John H. Caruso, Robert C. Cashner, Glenn H. Clemmer, Charles D. Hancock, Julian M. Humphries, Clyde Jones, Rudolf Meier, Maurice F. Mettee, Patrick E. O'Neil, J. Malcolm Pierson, Susan Pollock, John S. Ramsey, Dawn Remington, Steven Rohmann, Gerald R. Smith, Diana W. Stein, Jamie Thomerson, Bruce A. Thompson, Veronica Trau Colbert, and Ralph W. Yerger. We are grateful to M. F. Mettee, P. E. O'Neil, J. M. Pierson, and B. A. Thompson for their contributions of color slides. Paul R. Nichols, C. Lavett Smith, and Teruya Uyeno participated in the assembling of data, and Dr. Smith unselfishly withdrew from a planned description of *E. colorosum* initiated long ago. Several years ago R. D. Suttkus made a cursory examination of the University of Alabama's holdings of *E. bellator* and *E. colorosum* through the courtesy of H. T. Boschung and later additional lots were examined through the courtesy of R. L. Mayden. Although none of the specimens was used to determine meristics or morphometrics for this study, we have taken the liberty of adding some of the (UAIC) locality data to the distribution maps. More recently M. F. Mettee offered new records of *E. colorosum* that he and his staff at the Geological Survey of Alabama accumulated during the past two years; all new localities were added to our distribution map. To all of these individuals we express our deep appreciation.

We are especially indebted to John S. Ramsey for copies of his field notes, his detailed color notes of specimens in nuptial condition, his shared thinking about the relationships of the various species, and his preliminary key to all described and undescribed species of *Ulocentra* that were known during the early 1970's.

We thank Ralph W. Yerger for the early loan of the extensive collections of *E. colorosum* formerly housed at Florida State University. Too, we thank George Burgess for his prompt response to our request for University of Florida (UF) catalog numbers for the respective Florida State University series. We thank Henry L. Bart, Jr. for extending the loan of materials from Auburn University, and we are indebted to him and his staff for the many courtesies extended to us at the Tulane University Museum of Natural History, and to two anonymous reviewers.

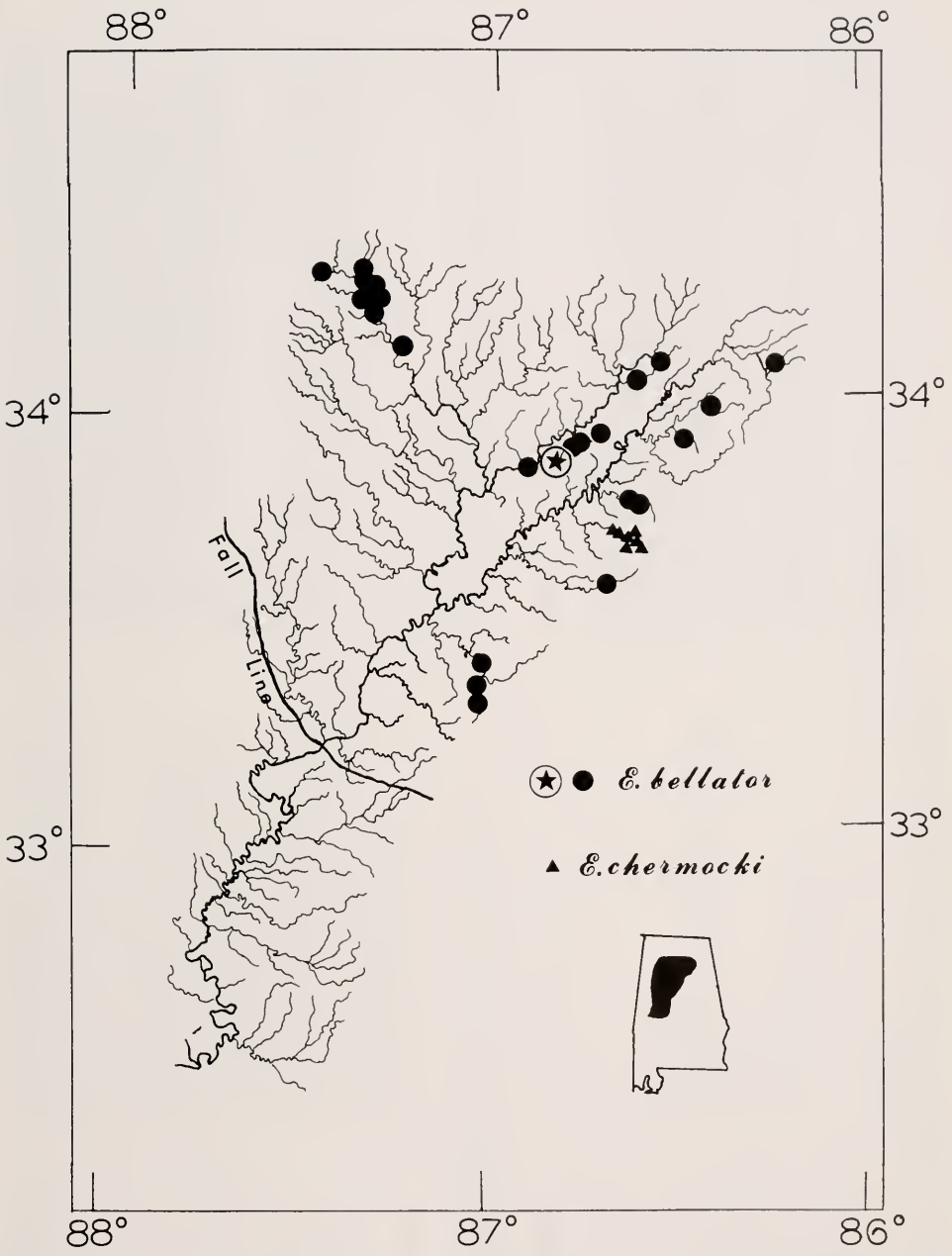

Figure 13. Black Warrior River system, Alabama, showing distribution of *Etheostoma bellator* (solid circles; type locality solid star in open circle), and *E. chermocki* (small solid triangles).

TABLE 7. Comparison of nuptial males of *Etheostoma bellator* and *E. chermocki*.

Character	*E. bellator*	*E. chermocki*
SPINOUS DORSAL FIN		
Marginal edging	thin edging of turquoise color	thin edging, clear or pale anteriorly, turquoise posteriorly
Ocellus in first membrane	bright red	bright red in smaller males, slightly darker in larger males
Submarginal red band	moderately wide, nearly uniform in width, often increasing in width posteriorly	variable in pattern, usually in two bands, separated anteriorly but with varying amount of inter-connection posteriorly; the outer band is narrow and weakly developed in its anterior third, behind the ocellus; the inner band is variable in width and intensity, and is usually incomplete, not extending to anterior margin of fin
Subbasal black band	narrow, uniform in intensity	similar, narrow, uniform in intensity
Cream colored bands, distal and proximal to black band	both present, fringed with yellow	both present in smaller males, fringed with yellow; inner band only developed in larger males
SOFT-RAYED DORSAL FIN Red band	typically relatively narrow in width, occasionally moderately broad	typically moderately broad
LATERAL BLOTCHES (centered along lower edge of lateral-line)	basically brown, nearly obliterated by overlay of flesh or pink coloration; some olive coloration extends, from dorsum, ventrad to upper edges of lateral blotches	basically brown, not obliterated by overlay of light colors; some olive coloration extends, from dorsum, ventrad to upper edges of lateral blotches
LATERAL BLOTCHES (centered above lateral-line)	mostly elongate blotches ranging from red posteriorly, to orange, to russet anteriorly; this series of blotches separated from lateral brown blotches (expecially anteriorly) by a pronounced pale area	elongate to oblong blotches ranging from bright red posteriorly to dull red anteriorly in smaller males and ranging from dull red posteriorly, to russet, to brown anteriorly in larger males; this series of blotches separated from lateral brown blotches (anteriorly only) by a very narrow pale area in smaller males, no separation in larger males
CHROMATIC COLORATION on dorsal-lateral area of body	scattering of flecks or small blotches of red or orange coloration	scattering of flecks or small blotches of red or orange in smaller males; no red or orange, instead, flecks or small blotches of brown or olive in larger males

VENTRAL-LATERAL CHROMATIC COLORATION	narrow stripe of red or orange color, low on side, well separated from lower edges of lateral blotches	in smaller males a broad stripe of bright red extending nearly to ventral margins of lateral blotches at midbody, but extending to the ventral margins of blotches on caudal peduncle; in the larger males a broad stripe of dull red extending to ventral margins of lateral blotches at midbody as well as along caudal peduncle, and the dull red extends dorsad between the posterior blotches
OVERALL CONFIGURATION (Table 4; Boschung et al. Table 1)	more slender; caudal peduncle longer and dorsal fins lower	stockier; caudal peduncle shorter and dorsal fins more elevated

Literature Cited

Bailey, R. M. and D. A. Etnier. 1988. Comments on the subgenera of darters (Percidae) with descriptions of two new species of *Etheostoma* (*Ulocentra*) from southeastern United States. Misc. Publ. Mus. Zool. Univ. Michigan 175: 1-48.

Bailey, R. M. and W. A. Gosline. 1955. Variation and systematic significance of vertebral counts in the American fishes of the family Percidae. Misc. Publ. Mus. Zool. Univ. Michigan 93: 1-44.

Bailey, R. M., H. E. Winn, and C. L. Smith. 1954. Fishes from the Escambia River, Alabama and Florida, with ecologic and taxonomic notes. Proc. Acad. Nat. Sci. Philadelphia 106: 109-164.

Boschung, H. T., R. L. Mayden, and J. R. Tomelleri. 1992. *Etheostoma chermocki*, a new species of darter (Teleostei: Percidae) from the Black Warrior River drainage of Alabama. Bull. Alabama Mus. Nat. Hist. 13: 11-20.

Bouchard, R. W. 1977. *Etheostoma etnieri*, a new percid fish from the Caney Fork (Cumberland) River system, Tennessee, with a redescription of the subgenus *Ulocentra*. Tulane Stud. Zool. Bot. 19: 105-130.

Dycus, D. L. and W. M. Howell. 1974. Fishes of the Bankhead National Forest of Alabama. Alabama Dept. Cons. Natur. Resources, Div. Game & Fish, 51 pp.

Fowler, H. W. 1945. A study of the fishes of the southern Piedmont and Coastal Plain. Monogr. Acad. Nat. Sci. Philadelphia 7: 1-408.

Gilbert, C. H. 1891. Report of explorations made in Alabama during 1889, with notes on the fishes of the Tennessee, Alabama, and Escambia rivers. Bull. U. S. Fish Commission (1889) 9: 143-159.

Gilbert, C. R. and S. J. Walsh. 1991. Provenance and disposition of fish specimens appearing in color plates of Kuehne and Barbour's book, *The American Darters*. Proc. Southeastern Fishes Council No. 24: 12-19.

Hubbs, C. L. and K. F. Lagler. 1958. Fishes of the Great Lakes region. Cranbrook Inst. Sci. Bull. 26, 213 pp.

Jenkins, R. E. 1976. A list of the undescribed freshwater fish species of continental United States and Canada, with additions to the 1970 checklist. Copeia 1976: 642-644.

Kuehne, R. A. and R. W. Barbour. 1983. The American Darters. Univ. Kentucky Press, Lexington, 201 pp.

Mettee, M. F. 1978. The fishes of the Birmingham-Jefferson County Region of Alabama with ecologic and taxonomic notes. Geol. Survey Alabama Bull. no. 115, 182 pp.

Mattee, M. F., P. E. O'Neil, and S. C. Harris. 1983. A biological inventory of streams draining the Citronelle, Pollard and Gilbertown Oil Fields in Alabama. Geol. Survey Alabama Circular 108, 101 pp.

Mettee, M. F., P. E. O'Neil, J. M. Pierson, and R. D. Suttkus. 1989a. Fishes of the Black Warrior River system in Alabama. Geol. Survey Alabama Bull. no. 133, 201 pp.

Mettee, M. F., P. E. O'Neil, J. M. Pierson, and R. D. Suttkus. 1989b. Fishes of the western Mobile River basin in Alabama and Mississippi. Geol. Survey Alabama Atlas no. 24, 170 pp.

Page, L. M. 1983. Handbook of Darters. T. F. H. Publications, Inc. Neptune City, New Jersey, 271 pp.

Page, L. M. and B. M. Burr. 1991. A Field Guide to Freshwater Fishes, North America, North of Mexico. Houghton Mifflin Co., Boston, Mass., 432 pp.

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada (5th ed.). Amer. Fish. Soc. Spec. Publ. no. 20, 183 pp.

Smith-Vaniz, W. F. 1968. Freshwater Fishes of Alabama. Auburn Univ. Agric. Exper. Sta., 211 pp.

Stevenson, H. M. 1976. Vertebrates of Florida, Identification and Distribution. University Presses of Florida, Gainesville, 607 pp.

Suttkus, R. D. and D. A. Etnier. 1991. *Etheostoma tallapoosae* and *E. brevirostrum*, two new darters, subgenus *Ulocentra*, from the Alabama River drainage. Tulane Stud. Zool. Bot. 28: 1-24.

TYPE SPECIMENS OF FISHES IN THE TULANE UNIVERSITY MUSEUM OF NATURAL HISTORY

Henry L. Bart, Jr. and Michael S. Taylor
Tulane University Museum of Natural History
Department of Ecology, Evolution, and Organismal Biology
Tulane University, New Orleans, LA 70118

Introduction

This type list is being published in accordance with Recommendation 72G of the International Code of Zoological Nomenclature (3rd Edition), which encourages institutions housing name-bearing types to periodically publish listings of those types. This is the second listing of types of fishes in the Tulane University Museum of Natural History, and is intended to update the first list, published 23 years ago (Suttkus, 1970). That first list included a history of the Tulane fish collection, which is briefly updated here to provide information on the status of the collection and its curation.

At the time of publication of the first type list, the fish collection, including the type collection, was in the process of being moved to the F. Edward Hebert ("Riverside") Research Laboratories on the west bank of the Mississippi River near Belle Chasse (15 miles from Tulane's main campus in New Orleans). The Systematics and Environmental Biology Laboratory, the facility that initially incorporated the fish collection, was formally established in 1971. In 1976, Royal D. Suttkus, the collection's founder and first Curator, convinced the Tulane University administration to designate systematic collections at Riverside as the Tulane University Museum of Natural History.

Suttkus retired from Tulane University in 1990, but continues to work in the collection in his present capacity as Emeritus Curator. Also in 1990, the Biology Department at Tulane was reorganized. The Museum is presently administered through the Department of Ecology, Evolution, and Organismal Biology, Milton Fingerman, Chair. The senior author was hired as Curator of Fishes and Director of the Museum in 1992. The junior author was hired as Collection Manager also in 1992.

Zoological collections in the Museum of Natural History are currently housed in four of 26 World War II-vintage ammunition bunkers on the Riverside campus. The fish collection is largely contained in Bunker A-3 near the rear of the complex, but overflows into parts of two additional bunkers (A-2 and A-14). The fish collection has been expanding at a rate of 4500 lots and 200,000 specimens per year. As of August 1992, it contained 6,137,652 fluid-preserved specimens cataloged in 163,469 lots (an average of 37.5 specimens per lot). In addition, there is an osteological collection with 1352 specimens, of which 638 are cleared and stained preparations; there are 2010 radiographs representing 21,988 specimens; and there are 2428 scale and otolith samples

Type Collection

Type material is housed in a separate 104 sq. ft. room in the main fish collection bunker. The arrangement of material on the shelves follows Berg

(1940). At present, the type collection includes 33 holotypes and 38,835 paratypes representing 125 fish species. All but the largest type specimens are stored in glass jars of the highest quality. The necks of jars containing holotypes are painted red, those of jars containing paratypes are painted blue. Types of *Scaphirhynchus suttkusi* are kept in a stainless steel tank in the type room. Paratypes of *Ophichthus rex* are stored in an eight ft. wooden tank in the fish range. Also in the type room is a file of all original literature, and a color-coded card file with data on types and original literature arranged chronologically and phylogenetically. The type room also houses two specimens of the extinct harelip sucker, *Lagochila lacera*, on permanent loan from Cornell University, as well as specimens of certain rare or Federally endangered species.

Types of the Tulane fish collection are listed below in Berg family order. Each listing includes the original species name, author(s), year of publication and page on which species name appears, and list of types. Complete citations for the original descriptions are provided in the literature cited. The holotype is listed first if present. Paratypes collected with the holotype are always the first entry in the paratype listings; remaining paratypes are listed by increasing catalog number, which approximates a chronological listing. The complete collection record is provided in all instances except listings of paratypes collected with listed holotypes. Any corrections, information of the status of types, and other information updating Suttkus (1970) are given in parentheses at the end of the listing. Institutional abbreviations follow Leviton et al. (1985).

List of Type Specimens

Acipenseridae

Scaphirhynchus suttkusi Williams & Clemmer, 1991: 19.

HOLOTYPE: **TU 135000**, from Alabama, Monroe Cnty., oxbow lake of Tensaw R. just above Little R., 18 March 1977, GHC 1411, collected by W. E. Smith.

PARATYPES: **TU 50553**, 1 specimen from Alabama, Monroe Cnty., Alabama R. at Bear Cr., river mi. 112.8, 2 March 1968, RDS 4295, collected by J. Gaddy (fisherman); **TU 52868**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Clifton Ferry Landing, river mi. 137.3, 29 June 1968, collected by R. D. Suttkus; **TU 64937**, 1 specimen from Alabama, Perry Cnty., Cahaba R. near Marion fish hatchery, 1 mi. W of Sprott, 30 April 1966, collected by Green; **TU 135001**, 1 specimen from Alabama, Monroe Cnty., overflow lake of Tensaw R. just above mouth of Little R., 5 April 1977, GHC 1412, collected by W. E. Smith (incorrectly listed as TU 350001 in description).

Clupeidae

Brevoortia gunteri Hildebrand, 1948: 31.

PARATYPE: **TU 10792**, 1 specimen from Texas, Aransas Cnty., Aransas Bay, collected by G. Gunter (formerly USNM 129802).

Sudidae (= Chlorophthalmidae)

Chlorophthalmus brasiliensis Mead, 1958: 362.

PARATYPES: **TU 18374**, 4 specimens from Atlantic Ocean, 01°49'N, 46°48'W, 225 fms., 17 November 1958, Oregon Sta. 2083, collected by crew of M/V Oregon (inadvertently omitted from Suttkus, 1970).

Alepisauridae

Alepisaurus brevirostris Gibbs, 1960: 2.

PARATYPE: **TU 22990**, 1 specimen from Atlantic Ocean, 37°44'N, 65°42'W, 1957, collected by crew of M/V Delaware.

Characidae

Astyanax armandoi Lozano & Contreras, 1990: 97.

PARATYPES: **TU 157268**, 2 specimens from Chiapas, México, unnamed creek flowing through Pénjamo, near Palenque, 7 May 1980, MLLV 80-33, collected by M. L. Lozano (removed from UANL 6202).

Hysteronotus myersi Thomerson & Weitzman, 1970: 140.

PARATYPES: **TU 56456**, 2 specimens from Huanuco, Peru, descendents of specimens collected from a small creek near Tournavista, 23 August 1964, collected by J. E. Thomerson and party.

Cyprinidae

Algansea aphanea Barbour & Miller, 1978: 21.

PARATYPES: **TU 105478**, 10 specimens from Jalisco, México, Río de Ayutla 6.1 mi. W of junction Mascota Rd. and México Hwy. 80 and 3 mi. SE of Ayutla, 22 April 1969, collected by C. D. Barbour and R. J. Douglas (removed from UMMZ 192196).

Algansea monticola Barbour & Contreras, 1968: 101.

HOLOTYPE: **TU 40869**, from Zacatecas, México, Río Juchipila near town of Jalpa, at México Hwy. 70 bridge, one mi. E of the intersection with México Hwy. 41, 30 June 1963, CDB 63-27, collected by C. D. Barbour and S. Contreras.

PARATYPES: **TU 30611**, 49 specimens collected with holotype; **TU 30608**, 76 specimens from Zacatecas, México, Río Juchipila at Mal Paso (a little walled town) about 16 mi. E of Ciudad Garcia Salinas, 28 June 1963, CDB 63-23, collected by C. D. Barbour and S. Contreras; **TU 30609**, 131 specimens from Zacatecas, México, tributary to Río Juchipila, about 5 mi. S of Villanueva on México Hwy. 41, 28 June 1963, CDB 63-24, collected by C. D. Barbour and S. Contreras; **TU 30610**, 18 specimens from Zacatecas, México, Río Juchipila at Tabasco, upstream of bridge at south end of town, 29 June 1963, CDB 63-25, collected by C. D. Barbour and S. Contreras.

Algansea monticola avia Barbour & Miller, 1978: 10.

PARATYPES: **TU 30816**, 20 specimens from Nayarit, México, Río Tepic at México Hwy. 15, 27 mi. SE of Tepic, 1957, M57-12, collected by R. R. Miller and assistants; **TU 30817**, 13 specimens from Nayarit, México, Arroyo de Mazatán at Mazatán, 1955, M55-25, collected by R. R. Miller and assistants; **TU 30818**, 15 specimens from Nayarit, México, Río Compostela just S of Compostela, 1955, M55-40, collected by R. R. Miller and assistants.

Campostoma pauciradii Burr & Cashner, 1983: 105.

HOLOTYPE: **TU 117030**, from Georgia, Hall Cnty., Candler Cr., 1.1 mi. W of Gillsville, Georgia Hwy. 52, 24 April 1980, RDS 7314, collected by R. D. Suttkus, D. C. Scott, F. Myers, and S. Larson.

PARATYPES: **TU 117031**, 5 specimens collected with holotype; **TU 26138**, 1 specimen from Georgia, Gwinnett Cnty., Yellow R. 7 mi. E of Duluth, Georgia Hwy. 120, 20 April 1962, RDS 3057, collected by R. D. Suttkus, J. S. Ramsey, J. E. Thomerson, and C. D. Barbour (incorrectly listed as TU 25138 in description); **TU 30489**, 5 specimens from Georgia, Hall Cnty., North Oconee R. 5.9 mi. NE of Gainesville, U.S. Hwy. 23, 22 September 1963, JSR 63-47, collected by J. S. Ramsey; **TU 30499**, 3 specimens from Georgia, Hall Cnty., East Fork Oconee R. about 2 mi. N of Gillsville, Georgia Hwy. 52, 22 September 1963, JSR 63-48, collected by J. S. Ramsey; **TU 41351**, 10 specimens from Georgia, Hall Cnty., Flat Shoals Cr., at Georgia Hwy. 52 crossing, 1 mi. W of junction of Georgia Hwy. 323, 4 May 1966, GHC 440, collected by G. H. Clemmer and J. Reed; **TU 114877**, 25 specimens from Georgia, Hall Cnty., Candler Cr., 1.2 mi. W of Gillsville, Georgia Hwy. 52, 12 October 1979, RDS 7157, collected by R. D. Suttkus, R. C. Cashner, R. Gilbert, and A. R. Heidt; **TU 116945**, 1 specimen from Georgia, Hall Cnty., Candler Cr., 1.1 mi. W of Gillsville, Georgia Hwy. 52, 1 April 1980, RDS 7307, collected by R. D. Suttkus and B. J. Freeman; **TU 116956**, 3 specimens from Georgia, Hall Cnty., Candler Cr., 2 air mi. NW of Gillsville, 1 April 1980, RDS 7308, collected by R. D. Suttkus and B. J. Freeman; **TU 116964**, 5 specimens from Georgia, Hall Cnty., North Oconee R., 2.8 mi. W of U.S. Hwy. 23, along Whitehall Rd., 1 April 1980, RDS 7309, collected by R. D. Suttkus and B. J. Freeman; **TU 117042**, 13 specimens from Georgia, Hall Cnty., North Oconee R., 2.8 mi. W of U.S. Hwy. 23, along Whitehall Rd., 24 April 1980, RDS 7315, collected by R. D. Suttkus, D. C. Scott, F. Myers, and S. Larson.

Dionda mandibularis Contreras & Verduzco, 1977: 259.

PARATYPES: **TU 94115**, 2 specimens from San Luis Potosí, México, Arroyo, 7 km SSE of the town of Ríoverde, 14 July 1968, SCB 68-16, collected by S. Contreras and party (removed from UANL 1032).

Gila bicolor eurysoma Williams & Bond, 1981: 223.

HOLOTYPE: **TU 116230**, from Nevada, Washoe Cnty., Fish Cr., approximately 0.8 km upstream from Andy's Place, 11 August 1978, JW 78-32, collected by J. E. Williams and C. Williams.

PARATYPES: **TU 116231**, 11 specimens collected with holotype.

Gila boraxobius Williams & Bond, 1980: 292.

PARATYPES: **TU 116232**, 8 specimens from Oregon, Harney Cnty., Hot Lake (= Borax Lake), 5 mi. N of Fields, 30 July 1972, collected by C. E. Bond (removed from OS 4138).

Hybopsis lineapunctata Clemmer & Suttkus, 1971: 22. (= *Notropis lineapunctatus*)

HOLOTYPE: **TU 53405**, from Alabama, Clay Cnty., Enitachope Cr., tributary to Hillabee Cr., 2.9 mi. SW of Ashland, Alabama Hwy. 9, 13 April 1966, RDS 3877, collected by R. D. Suttkus and G. H. Clemmer.

PARATYPES: **TU 40643**, 46 specimens collected with holotype; **TU 12085**, 8 specimens from Alabama, Elmore Cnty., Gold Branch, 6 mi. N of Eclectic, Alabama Hwy. 63, 5 October 1955, RDS 2525, collected by R. D. Suttkus; **TU 15281**, 156 specimens from Alabama, Elmore Cnty., Gold Branch, tributary to Channahatchee Cr., 6 mi. N of Eclectic, Alabama Hwy. 63, 16 March 1957, RDS 2592, collected by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. DeAbate; **TU 29884**, 1 specimen from Alabama, Clay Cnty., Enitachope Cr., tributary to Hillabee Cr., 3.2 mi. SW of Ashland, Alabama Hwy. 9, 21 September 1963, JSR 63-46, collected by J. S. Ramsey; **TU 32729**, 8 specimens from Alabama, Clay Cnty., Enitachope Cr., 2.9 mi. S of Ashland, Alabama Hwy. 9, 1 June 1964, RDS 3462, collected by R. D. Suttkus and J. S. Ramsey; **TU 40668**, 12 specimens from Alabama, Randolph Cnty., tributary to Little Tallapoosa R., 2.9 mi. W of intersection of U.S. Hwy. 431 and Alabama Hwy. 82, 13 April 1966, RDS 3878, collected by R. D. Suttkus and G. H. Clemmer; **TU 41118**, 28 specimens from Alabama, Elmore Cnty., Gold Branch, tributary to Tallapoosa R., 6 mi. N of Eclectic, Alabama Hwy. 63, 12 April 1966, RDS 3873, collected by R. D. Suttkus and G. H. Clemmer; **TU 41132**, 1 specimen from Alabama, Elmore Cnty., Channahatchee Cr., tributary to Tallapoosa R., 2.5 mi. S of Red Hill, Alabama Hwy. 229, 12 April 1966, RDS 3874, collected by R. D. Suttkus and G. H. Clemmer.

Nocomis asper Lachner & Jenkins, 1971b: 3.

PARATYPES: **TU 48547**, 9 specimens from Arkansas, Benton Cnty., Spavinaw Cr. hole no. 3, 10 June 1966, University of Arkansas graduate students; **TU 48613**, 28 specimens from Arkansas, Benton Cnty., Spavinaw Cr. hole no. 2, 10 June 1966, University of Arkansas graduate students; **TU 48658**, 14 specimens from Arkansas, Benton Cnty., Spavinaw Cr. hole no. 4, 10 June 1966, University of Arkansas graduate students.

Nocomis effusus Lachner & Jenkins, 1967: 560.

PARATYPES: **TU 19488**, 2 specimens from Tennessee, Rutherford Cnty., Stones R., 6.5 mi. N of Murfreesboro, U.S. Hwy. 231, 7 September 1958, RDS 2758, collected by R. D. Suttkus and M. Andersson; **TU 32838**, 5 specimens from Tennessee, Fentress Cnty., tributary to Wolf R., 9.8 mi. N of Jamestown, U.S. Hwy. 127, 3 June 1964, RDS 3474, collected by R. D. Suttkus and J. S. Ramsey; **TU 33115**, 2 specimens from Tennessee, Cheatham Cnty., Harpeth R., 8 mi. E of White Bluff, U.S. Hwy. 70, 15 July 1964, JSR 64-60, collected by J. S. Ramsey and D. W. Walton; **TU 33125**, 11 specimens from Tennessee, Williamson Cnty., South Harpeth R., 4.2 mi. E of Fairview, Tennessee Hwy. 96, 15 July

1964, JSR 64-61, collected by J. S. Ramsey and D. W. Walton; **TU 33171**, 21 specimens from Tennessee, Rutherford Cnty., West Fork Stones R. at W edge of Murfreesboro, Tennessee Hwy. 96, 15 July 1964, JSR 64-63, collected by J. S. Ramsey and D. W. Walton; **TU 33194**, 1 specimen from Tennessee, Rutherford Cnty., Stones R. at S limit of Walterhill, U.S. Hwy. 231, 16 July 1964, JSR 64-64, collected by J. S. Ramsey and D. W. Walton.

Nocomis leptocephalus interocularis Lachner & Wiley, 1971: 6.

PARATYPES: **TU 12231**, 6 specimens from Georgia, Rabun Cnty., Timspon Cr., 5.4 mi. W of Clayton, U.S. Hwy. 76, 8 October 1955, RDS 2533, collected by R. D. Suttkus and party; **TU 26178**, 11 specimens from Georgia, Madison Cnty., South Fork Broad R., 1 mi. W of Comer, Georgia Hwy. 72, 21 April 1962, RDS 3061, collected by R. D. Suttkus, J. S. Ramsey, J. E. Thomerson, and C. D. Barbour; **TU 26181**, 19 specimens from Georgia, Madison Cnty., South Fork Broad R., 1 mi. S of Carlton, 21 April 1961, RDS 3062, collected by R. D. Suttkus, J. S. Ramsey, J. E. Thomerson, and C. D. Barbour; **TU 26190**, 30 specimens from South Carolina, Anderson Cnty., tributary to Savannah R. 5 mi. W of Iva, South Carolina Hwy. 184, 21 April 1962, RDS 3063, collected by R. D. Suttkus, J. S. Ramsey, J. E. Thomerson, and C. D. Barbour; **TU 26955**, 12 specimens from South Carolina, Oconee Cnty., Little R. 8 mi. NE of Walhalla on South Carolina Hwy. 11, 5 July 1962, JSR 62-117, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 26971**, 5 specimens from South Carolina, Oconee Cnty., Thompson R., tributary to Whitewater R., 1.4 mi. S of South Carolina-North Carolina state line in Sumter National Forest, 10 July 1962, JSR 62-122, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 26974**, 5 specimens from South Carolina, Oconee Cnty., Chauga R. 15.9 mi. S of Georgia-South Carolina state line on South Carolina Hwy. 28, 13 July 1962, JSR 62-136, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 26979**, 1 specimen from Georgia, Rabun Cnty., and South Carolina, Oconee Cnty., Chattooga R. at Georgia-South Carolina state line, South Carolina Hwy. 28 above junction with West Fork, 13 July 1962, JSR 62-135, collected by J. S. Ramsey, W. S. Woolcott, H. H. Howell, and D. H. Howell; **TU 26996**, 6 specimens from South Carolina, Pickens/Oconee Cnty. line, confluence of Horsepasture and Toxaway rivers, 1.5 mi. S of North Carolina-South Carolina state line, 21 July 1962, JSR 62-152, collected by J. S. Ramsey and H. H. Howell; **TU 27001**, 34 specimens from North Carolina, Transylvania Cnty., Bearcamp Cr., tributary to Horsepasture R., 4.0 mi. S of Oakland, 24 July 1962, JSR 62-155, collected by J. S. Ramsey and H. H. Howell; **TU 28017**, 2 specimens from North Carolina, Jackson Cnty., tributary to Chattooga R. 1.7 mi. S of Cashiers, North Carolina Hwy. 107, 4 June 1962, JSR 62-67, collected by J. S. Ramsey and W. S. Woolcott; **TU 28023**, 15 specimens from North Carolina, Transylvania Cnty., Horsepasture R., tributary to Toxaway R., 0.5 mi. N of North Carolina-South Carolina state line, 6 June 1962, JSR 62-72, collected by J. S. Ramsey and W. S. Woolcott; **TU 29261**, 5 specimens from North Carolina, Transylvania Cnty., Bearwallow Cr. near confluence with Toxaway R., 1.9 mi. due N of North Carolina-South Carolina state line, 7 June 1962, JSR 62-73, collected by J. S. Ramsey and W. S. Woolcott; **TU 29288**, 11 specimens from North Carolina, Transylvania Cnty., Bearwallow Cr. at confluence with Toxaway R., 2 mi. due N of South Carolina state line, 10 June 1962, JSR 62-79, collected by J. S. Ramsey and W. S. Woolcott; **TU 29303**, 5 specimens from North Carolina, Transylvania Cnty., Horsepasture

R. 1.1 mi. S of Oakland on Sapphire Rd., 14 June 1962, JSR 62-81, collected by J. S. Ramsey and W. S. Wolcott; **TU 29309**, 21 specimens from North Carolina, Transylvania Cnty., Toxaway R. above Lake Toxaway, 2.6 mi. W of Lake Toxaway (town) on gravel road, 15 June 1962, JSR 62-88, collected by J. S. Ramsey and W. S. Woolcott; **TU 29314**, 10 specimens from North Carolina, Transylvania Cnty., Horsepasture R., 2.5 mi. S of Oakland on Whitewater Rd., 18 June 1962, JSR 62-90, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29319**, 7 specimens from North Carolina, Transylvania Cnty., Horsepasture R., 3 mi. S of Oakland on gravel road, 18 June 1962, JSR 62-91, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29322**, 9 specimens from Georgia, Habersham Cnty., Panther Cr., tributary to Tallulah R. 3.9 mi. SW of Tallulah Falls, U.S. Hwy. 441, 19 June 1962, JSR 62-92, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29329**, 24 specimens from Georgia, Rabun Cnty., Tallulah R. 1.5 mi. S of Wiley, U.S. Hwy. 441, 19 June 1962, JSR 62-93, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29391**, 12 specimens from North Carolina, Transylvania Cnty., Bearcamp Cr., tributary to Horsepasture R., 4.0 mi. S of Oakland, 25 June 1962, JSR 62-103, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29420**, 8 specimens from North Carolina, Transylvania Cnty., Bearcamp Cr., tributary to Horsepasture R., 0.2 mi. N of South Carolina state line, 28 June 1962, JSR 62-107, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29422**, 2 specimens from North Carolina, Transylvania Cnty., Bearwallow Cr., tributary to Toxaway R., below 60 ft. falls, 1.7 mi. N of South Carolina state line, 29 June 1962, JSR 62-108, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29436**, 3 specimens from North Carolina, Transylvania Cnty., Horsepasture R. between Drift Falls and Rainbow Falls, 2.6 mi. SW of Oakland, 3 July 1962, JSR 62-110, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29449**, 6 specimens from North Carolina, Transylvania Cnty., Toxaway R. just below Toxaway Falls, Hwy. 64, 7 July 1962, JSR 62-118, collected by J. S. Ramsey and W. S. Woolcott; **TU 29450**, 1 specimen from North Carolina, Transylvania Cnty., Toxaway R. above Lake Toxaway, 2.6 mi. West of Lake Toxaway (town) on gravel road, 2 July 1962, JSR 62-119, collected by J. S. Ramsey and W. S. Woolcott; **TU 29461**, 2 specimens from South Carolina, Oconee Cnty., Bearcamp Cr. near junction with Horsepasture R., 0.5 mi. SE of North Carolina state line, 10 July 1962, JSR 62-123, collected by J. S. Ramsey, W. S. Woolcott, and H. H. Howell; **TU 29534**, 11 specimens from North Carolina, Transylvania Cnty., Toxaway R. above Lake Toxaway, 2.6 mi. W of Lake Toxaway (town) on gravel road, 14 July 1962, JSR 62-138, collected by J. S Ramsey, H. H. Howell, D. H. Howell, and W. C. Howell; **TU 29585**, 13 specimens from South Carolina, Pickens-Oconee Cnty. line, Toxaway R. 0.25 mi. S of junction with North Carolina state line, 23 July 1962, JSR 62-154, collected by J. S. Ramsey and H. H. Howell; **TU 29599**, 27 specimens from North Carolina, Transylvania Cnty., Toxaway Cr., tributary to Toxaway R., about 3 mi. due SW of Rosman, gravel road, 31 July 1962, JSR 62-157, collected by J. S. Ramsey and H. H. Howell; **TU 29652**, 5 specimens from North Carolina, Jackson Cnty., Chattooga R. 2.7 mi. due S of Cashiers, gravel road, 7 August 1962, JSR 62-169, collected by J. S. Ramsey; **TU 29784**, 12 specimens from North Carolina, Transylvania Cnty., Bearcamp Cr., tributary to Horsepasture R., 4.0 mi. S of Oakland, 27 August 1962, JSR 62-198, collected by J. S. Ramsey; **TU 37510**, 65 specimens from Georgia, Banks Cnty., Hudson R., tributary to Broad R. about 2 mi. N of Homer, U.S. Hwy 441, 24 April 1965, RDS

3656, collected by R. D. Suttkus and F. L. Rose; **TU 38588**, 9 specimens from Georgia, Columbia Cnty., Little Kiokee Cr., 10.5 mi. N of Evans, 27 June 1965, FLR 1, collected by F. L. Rose and J. L. Rose; **TU 38597**, 3 specimens from Georgia, Richmond Cnty., Rays Cr. at crossing of Walton Way extension in Augusta, 5 July 1965, FLR 2, collected by F. L. Rose and J. L. Rose; **TU 38605**, 2 specimens from Georgia, Richmond Cnty., Rays Cr. at crossing of Barkman Rd. in Augusta, 6 July 1965, FLR 3, collected by F. L. Rose, J. L. Rose, and W. T. Rose; **TU 38613**, 15 specimens from South Carolina, McCormick Cnty., Stevens Cr. 1.4 mi. N of Parksville, Cnty. Rd. S33-21, 7 July 1965, FLR 4, collected by F. L. Rose, J. L. Rose, and W. T. Rose; **TU 38623**, 4 specimens from South Carolina, Edgefield Cnty., tributary to Stevens Cr., 4.6 mi. E of Parksville, Cnty. Rd. S33-138, 7 July 1965, FLR 5, collected by F. L. Rose, J. L. Rose, and W. T. Rose; **TU 39477**, 9 specimens from South Carolina, Edgefield Cnty., Log Cr. at U.S. Hwy. 25 crossing, 4 mi. N of U.S. Hwy. 25-25A intersection, just N of Edgefield, 25 October 1965, GHC 366, collected by G. H. Clemmer and F. L. Rose; **TU 39486**, 2 specimens from Georgia, Columbia Cnty., Little Kiokee Cr., 10.5 mi. N of Evans on dirt road, 26 October 1965, GHC 367, collected by G. H. Clemmer and F. L. Rose.

Nocomis platyrhynchus Lachner & Jenkins, 1971a: 37.

PARATYPES: **TU 25902**, 17 specimens from North Carolina, Ashe Cnty., South Fork New R., 4 mi. SW of Scottville, U.S. Hwy. 221, 19 June 1962, RDS 3109, collected by R. D. Suttkus and M. M. May.

Nocomis raneyi Lachner & Jenkins, 1971a: 17.

PARATYPES: **TU 25885**, 3 specimens from Virginia, Roanoke Cnty., Roanoke R., 8 mi. SW of Salem, U.S. Hwy. 11, 18 June 1962, RDS 3107, collected by R. D. Suttkus and M. M. May.

Notropis aguirrepequenoi Contreras & Rivera, 1973: 259.

PARATYPES: **TU 94116**, 20 specimens from Tamaulipas, México, Río Pilón at México Hwy. 85, 21 May 1966, SCB 66-8, collected by S. Contreras and party (removed from UANL 1137).

Notropis ammophilus Suttkus & Boschung, 1990: 50.

HOLOTYPE: **TU 151630**, from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr., 0.4 mi. N of Alberta, Alabama Hwy. 5, 9 April 1988, RDS 9534, collected by R. D. Suttkus.

PARATYPES: **TU 151631**, 124 specimens collected with holotype; **TU 60871**, 1147 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr., 0.4 mi. N of Alberta, Alabama Hwy. 5, 18 December 1969, RDS 4709, collected by R. D. Suttkus and R. C. Cashner; **TU 121386**, 129 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 15 May 1981, RDS 7553, collected by R. D. Suttkus; **TU 125388**, 292 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 15 May 1982, RDS 7857, collected by R. D. Suttkus and D. W. Stein; **TU 140934**, 207 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee

Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 24 May 1985, RDS 8770, collected by R. D. Suttkus; **TU 145519**, 117 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 20 May 1986, RDS 9030, collected by R. D. Suttkus; **TU 153083**, 98 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 2 August 1988, RDS 9656, collected by R. D. Suttkus; **TU 153185**, 296 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 3 August 1988, RDS 9661, collected by R. D. Suttkus; **TU 154399**, 25 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 3 February 1989, RDS 9768, collected by R. D. Suttkus; **TU 154734**, 19 specimens from Alabama, Dallas-Wilcox Cnty. line, Chilatchee Cr. 0.4 mi. N of Alberta, Alabama Hwy. 5, 9 May 1989, RDS 9799, collected by R. D. Suttkus.

Notropis asperifrons Suttkus & Raney, 1955c: 4.

PARATYPES: **TU 2974**, 22 specimens from Alabama, Wilcox Cnty., Gravel Cr. tributary to Pursley Cr., 6.3 mi. S of Camden, Hwy. 11, 3 June 1951, RDS 2140, collected by R. D. Suttkus and C. D. Hancock; **TU 3063**, 5 specimens from Alabama, Wilcox Cnty., tributary to Pursley Cr., 1.8 mi. E of Camden, Alabama Hwy. 10, 3 June 1951, RDS 2138, collected by R. D. Suttkus and C. D. Hancock; **TU 3426**, 8 specimens from Alabama, Wilcox Cnty., Pursley Cr., tributary to Alabama R., 3.4 mi. SW of Camden, Hwy. 11, 3 June 1951, RDS 2139, collected by R. D. Suttkus and C. D. Hancock; **TU 4251**, 28 specimens from Alabama, Shelby Cnty., tributary to Waxahatchee Cr., 4.7 mi. SW of Columbiana on Alabama Hwy. 25, 15 June 1952, RHG 356, collected by R. H. Gibbs and P. P. Caswell; **TU 97113**, 5 specimens from Georgia, Murray Cnty., tributary to Holly Cr. at Ramhurst, 8 mi. N of the Murray Cnty. line, U.S. Hwy. 411, 12 June 1952, RHG 342, collected by R. H. Gibbs and P. P. Casell (removed from CU 28263).

Notropis atrapiculus Snelson, 1972: 58. (= *Lythrurus atrapiculus*)

PARATYPES: **TU 2509**, 36 specimens from Alabama, Houston Cnty., Panther Cr., tributary to Little Choctawhatchee R., 3 mi. west of Pinckard Farm Rd. and U.S. Hwy. 84, 29 May 1951, RDS 2108, collected by R. D. Suttkus (incorrectly listed as Pinehard Rd. in original description).

Notropis baileyi Suttkus & Raney, 1955a: 71.

PARATYPES: **TU 2637**, 29 specimens from Alabama, Monroe Cnty., tributary to Alabama R., 17.3 mi. S of Camden, Hwy. 11, 3 June 1951, RDS 2141, collected by R. D. Suttkus and C. D. Hancock (destroyed); **TU 2965**, 4 specimens from Alabama, Wilcox Cnty., Gravel Cr., tributary to Pursley Cr., 6.3 mi. S of Camden, Hwy. 11, 3 June 1951, RDS 2140, collected by R. D. Suttkus and C. D. Hancock; **TU 3066**, 41 specimens from Alabama, Wilcox Cnty., tributary to Pursley Cr., 1.8 mi. E of Camden, Alabama Hwy. 10, 3 June 1951, RDS 2138, collected by R. D. Suttkus and C. D. Hancock; **TU 3195**, 4 specimens from Alabama, Butler Cnty., Pine Barren Cr., 2.5 mi. S of Forest Home, 2 June 1951, RDS 2136, collected by R. D. Suttkus and C. D. Hancock; **TU 3430**, 75 specimens from Alabama, Wilcox Cnty., Pursley Cr., tributary to Alabama R., 3.4 mi. SW

of Camden, Hwy. 11, 3 June 1951, RDS 2139, collected by R. D. Suttkus and C. D. Hancock; **TU 97110**, 66 specimens from Alabama, Macon Cnty., tributary to Sawachlahatchee Cr., 1.7 mi. W of Society Hill on U.S. Hwy. 80, 12 June 1949, RDS 1051, collected by R. D. Suttkus, C. F. Cole, and R. H. Gibbs (formerly CU 16020).

Notropis bellus alegnotus Snelson, 1972: 37. (= *Lythrurus bellus alegnotus*)

PARATYPES: **TU 58810**, 10 specimens from Alabama, Jefferson Cnty., Five Mile Cr., tributary to Valley Cr., U.S. Hwy. 11 bridge, 5.0 air mi. SW of junction Alabama Hwy. 150 & U.S. Hwy. 11 bridge in Bessemer, 16 May 1969, FFS 69-7, collected by F. F. Snelson and B. W. Menzel.

Notropis cahabae Mayden & Kuhajda, 1989: 3.

PARATYPES: **TU 156264**, 3 specimens from Alabama, Bibb Cnty., Cahaba R. at mouth of unnamed tributary, 1.1 km downstream from mouth of Little Ugly Cr., 7 February 1985 (incorrectly listed as TU 156263 in original description) (removed from UAIC 8578.02).

Notropis candidus Suttkus, 1980: 3.

HOLOTYPE: **TU 103415**, from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 26 June 1969, RDS 4566, collected by R. D. Suttkus, G. E. Gunning, and R. C. Cashner.

PARATYPES: **TU 57763**, 84 specimens collected with holotype; **TU 40313**, 25 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 7 April 1966, RDS 3858, collected by R. D. Suttkus and G. E. Gunning; **TU 40903**, 26 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 28 June 1966, RDS 3918, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 40928**, 13 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 28 June 1966, RDS 3919, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 41414**, 35 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 1 July 1966, RDS 3924, R. D. Suttkus and Environmental Biology class; **TU 47903**, 109 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 26 September 1967, RDS 4202, collected by R. D. Suttkus, G. E. Gunning, and A. Kuris; **TU 52832**, 37 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 29 June 1968, RDS 4375, collected by R. D. Suttkus and G. E. Gunning; **TU 52854**, 23 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 29 June 1968, RDS 4376, collected by R. D. Suttkus and G. E. Gunning; **TU 76231**, 132 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 16 March 1972, RDS 5193, collected by R. D. Suttkus and B. A. Thompson; **TU 76253**, 203 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 16 March 1972, RDS 5194, collected by R. D. Suttkus and B. A. Thompson; **TU 80311**, 250 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 6 December 1972, RDS 5350, collected by R. D. Suttkus and R. C. Cashner; **TU 86774**, 212 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 19 March 1974, RDS 5590, collected by

R. D. Suttkus and B. A. Thompson; **TU 96458**, 139 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 18 December 1975, RDS 6087, collected by R. D. Suttkus and G. E. Gunning.

Notropis cardinalis Mayden, 1988: 156. (= *Luxilus cardinalis*)

PARATYPES: **TU 145026**, 3 specimens from Oklahoma, Ottawa Cnty., Five Mile Cr., T29N, R24E, Sec. 22, 9 May 1984, collected by F. B. Cross and R. L. Mayden (removed from KU 20963).

Notropis edwardraneyi Suttkus & Clemmer, 1968: 19.

HOLOTYPE: **TU 49485**, from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 8 March 1967, RDS 4097, collected by R. D. Suttkus and G. E. Gunning.

PARATYPES: **TU 44028**, 7324 specimens collected with holotype; **TU 33381**, 1613 specimens from Alabama, Dallas Cnty., Alabama R. at Watts Bar, 3.5 mi. upstream from Cahaba, river mi. 204.5, 29 June 1964, RDS 3515, collected by R. D. Suttkus and Environmental Biology class; **TU 35243**, 236 specimens from Alabama, Dallas Cnty., Alabama R. at old ferry landing across river from Cahaba, 27-28 June 1964, RDS 3508, collected by R. D. Suttkus and Environmental Biology class; **TU 35269**, 314 specimens from Alabama, Dallas Cnty., Alabama R. at Cahaba where Cahaba R. enters Alabama R., 28 June 1964, RDS 3513, collected by R. D. Suttkus, G. H. Clemmer, J. D. Archer, and J. V. Conner; **TU 35323,** 28 specimens from Alabama, Clarke Cnty., Alabama R. along left bank across river from Choctaw Bluff, 2 July 1964, RDS 3519, collected by R. D. Suttkus and Environmental Biology class; **TU 40293**, 297 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 7 April 1966, RDS 3857, collected by R. D. Suttkus and G. E. Gunning; **TU 40303**, 1020 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 7 April 1966, RDS 3858, collected by R. D. Suttkus and G. E. Gunning; **TU 40320**, 491 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.4, 7 April 1966, RDS 3859, collected by R. D. Suttkus and G. E. Gunning; **TU 40335**, 243 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.3, 7 April 1966, RDS 3860, collected by R. D. Suttkus and G. E. Gunning; **TU 40900**, 289 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 28 June 1966, RDS 3918, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 40925**, 85 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 28 June 1966, RDS 3919, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 40940**, 226 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.4, 28 June 1966, RDS 3920, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 40950**, 109 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.3, 29 June 1966, RDS 3921, collected by R. D. Suttkus, G. E. Gunning, and G. H. Clemmer; **TU 41400**, 390 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 4.6 mi. E of Yellow Bluff Post Office, 1 July 1966, RDS 3924, collected by R. D. Suttkus and Environmental Biology class; **TU 41608**, 284 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 4 October 1966, RDS 4011, collected by R. D. Suttkus and G. E. Gunning; **TU 41618**, 33 specimens from Alabama, Wilcox Cnty., Alabama

R. at Yellow Jacket Bar, river mi. 129.7, 4 October 1966, RDS 4012, collected by R. D. Suttkus and G. E. Gunning; **TU 41632**, 92 specimens from Alabama, Wilcox Cnty., Alabama R. at Reeves Bar, river mi. 128.5, 4 October 1966, RDS 4013, collected by R. D. Suttkus and G. E. Gunning; **TU 41639**, 187 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 4 October 1966, RDS 4014, collected by R. D. Suttkus and G. E. Gunning; **TU 41655**, 119 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.5, 5 October 1966, RDS 4015, collected by R. D. Suttkus and G. E. Gunning; **TU 41666**, 147 specimens from Alabama, Wilcox Cnty., Alabama R. at Ohio Bar, river mi. 111.6, 5 October 1966, RDS 4016, collected by R. D. Suttkus and G. E. Gunning; **TU 41670**, 301 specimens from Alabama, Monroe Cnty., Alabama R. at Stein Island, river mi. 107.5, 5 October 1966, RDS 4017, collected by R. D. Suttkus and G. E. Gunning; **TU 41695**, 83 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 5 August 1966, RDS 3945, collected by R. D. Suttkus and G. E. Gunning; **TU 41711**, 29 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 5 August 1966, RDS 3946, collected by R. D. Suttkus and G. E. Gunning; **TU 41726**, 16 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.7, 5 August 1967, RDS 3948, collected by R. D. Suttkus and G. E. Gunning; **TU 41732**, 19 specimens from Alabama, Wilcox Cnty., Alabama R. at Reeves Bar, river mi. 128.5, 5 August 1966, RDS 3949, collected by R. D. Suttkus and G. E. Gunning; **TU 41745**, 63 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 5 August 1966, RDS 3950, collected by R. D. Suttkus and G. E. Gunning; **TU 41755**, 12 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.5, 5 August 1966, RDS 3951, collected by R. D. Suttkus and G. E. Gunning; **TU 41761**, 9 specimens from Alabama, Wilcox Cnty., Alabama R. at Ohio Bar, river mi. 111.6, 5 August 1966, RDS 3952, collected by R. D. Suttkus and G. E. Gunning; **TU 41772**, 151 specimens from Alabama, Monroe Cnty., Alabama R. at Stein Island, river mi. 107.5, 5 August 1966, RDS 3953, collected by R. D. Suttkus and G. E. Gunning; **TU 41791**, 22 specimens from Alabama, Monroe Cnty., Alabama R. at St. James Bar, river mi. 104, 5 August 1966, RDS 3954, collected by R. D. Suttkus and G. E. Gunning; **TU 41797**, 4 specimens from Alabama, Monroe Cnty., Alabama R. at Bates Bar, river mi. 99, 5 August 1966, RDS 3955, collected by R. D. Suttkus and G. E. Gunning; **TU 41813**, 10 specimens from Alabama, Monroe Cnty., Alabama R. at Silver Cr. Bar, river mi. 87.6, 6 August 1966, RDS 3957, collected by R. D. Suttkus and G. E. Gunning; **TU 41823**, 1 specimen from Alabama, Monroe Cnty., Alabama R. at mouth of Limestone Cr., river mi. 80.1, 6 August 1966, RDS 3958, collected by R. D. Suttkus and G. E. Gunning; **TU 42731**, 370 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 19 December 1966, RDS 4065, collected by R. D. Suttkus and G. E. Gunning; **TU 42737**, 5630 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.5, 19 December 1966, RDS 4066, collected by R. D. Suttkus and G. E. Gunning; **TU 42746**, 687 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 19 December 1966, RDS 4067, collected by R. D. Suttkus and G. E. Gunning; **TU 42759**, 900 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.5, 19-20 December 1966, RDS 4068, collected by R. D. Suttkus and G. E. Gunning; **TU 44011**, 175 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 8 March 1967, RDS 4096, collected by R. D. Suttkus and G. E. Gunning; **TU 44029**, 94 specimens from

Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 9 March 1967, RDS 4098, collected by R. D. Suttkus and G. E. Gunning; **TU 44045**, 561 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.5, 9 March 1967, RDS 4099, collected by R. D. Suttkus and G. E. Gunning; **TU 46783**, 202 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.8, 31 May 1967, RDS 4143, collected by R. D. Suttkus and G. E. Gunning; **TU 46796**, 395 specimens from Alabama, Wilcox Cnty., Alabama R. at bar above Yellow Jacket Bar, 31 May 1967, RDS 4144, collected by R. D. Suttkus and G. E. Gunning; **TU 46802**, 223 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 31 May 1967, RDS 4145, collected by R. D. Suttkus and G. E. Gunning; **TU 46819**, 43 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 31 May 1967, RDS 4146, collected by R. D. Suttkus and G. E. Gunning; **TU 46830**, 32 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.5, 31 May-1 June 1967, RDS 4147, collected by R. D. Suttkus and G. E. Gunning; **TU 47346**, 64 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 7 August 1967, RDS 4177, collected by R. D. Suttkus and G. E. Gunning; **TU 47361**, 49 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 7 August 1967, RDS 4178, collected by R. D. Suttkus and G. E. Gunning; **TU 47374**, 86 specimens from Alabama, Wilcox Cnty., Alabama R. at Reeves Bar, river mi. 128.5, 7 August 1967, RDS 4179, collected by R. D. Suttkus and G. E. Gunning; **TU 47387**, 168 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 7-8 August 1967, RDS 4180, collected by R. D. Suttkus and G. E. Gunning; **TU 47396**, 33 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.6, 8 August 1967, RDS 4181, collected by R. D. Suttkus and G. E. Gunning; **TU 47408**, 475 specimens from Alabama, Wilcox Cnty., Alabama R. at Ohio Bar, river mi. 111.7, 8 August 1967, RDS 4182, collected by R. D. Suttkus, G. H. Clemmer, and G. E. Gunning; **TU 47420**, 173 specimens from Alabama, Monroe Cnty., Alabama R. at Stein Island, river mi. 107.5, 8 August 1967, RDS 4183, collected by R. D. Suttkus and G. E. Gunning; **TU 47435**, 229 specimens from Alabama, Monroe Cnty., Alabama R. at Bates Bar, river mi. 99.4, RDS 4184, collected by R. D. Suttkus and G. E. Gunning; **TU 47452**, 134 specimens from Alabama, Monroe Cnty., Alabama R. at Haines Island, river mi. 96, 8 August 1967, RDS 4185, collected by R. D. Suttkus and G. E. Gunning; **TU 47477**, 89 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 9 August 1967, RDS 4186, collected by R. D. Suttkus and G. E. Gunning; **TU 47491**, 24 specimens from Alabama, Monroe Cnty., Alabama R. at St. James Bar, river mi. 104, 10 August 1967, RDS 4187, collected by R. D. Suttkus and G. E. Gunning; **TU 47499**, 16 specimens from Alabama, Monroe Cnty., Alabama R. at Silver Cr. Bar, river mi. 87.7, 17 August 1967, RDS 4188, collected by R. D. Suttkus and G. H. Clemmer; **TU 47515**, 306 specimens from Alabama, Wilcox Cnty., Alabama R. at Hobbs Bar, river mi. 149.5, 18 August 1967, RDS 4189, collected by R. D. Suttkus and G. H. Clemmer; **TU 47762**, 143 specimens from Alabama, Wilcox Cnty., Alabama R. at Lower Canton Bar, river mi. 156.7, along left bank, 18 August 1967, RDS 4190, collected by R. D. Suttkus and G. H. Clemmer; **TU 47781**, 9 specimens from Alabama, Wilcox Cnty., Alabama R. at Lower Canton Bar, river mi. 156.7, along right bank, 18 August 1967, RDS 4191, collected by R. D. Suttkus and G. H. Clemmer; **TU 47822**, 85 specimens from Alabama, Wilcox Cnty., Alabama R. at Hurricane Island, river mi. 166.5, 19 August 1967, RDS 4193, collected by R. D. Suttkus

and G. H. Clemmer; **TU 47838**, 75 specimens from Alabama, Wilcox Cnty., Alabama R. at St. John Bar, river mi. 164.8, 19 August 1967, RDS 4192, collected by R. D. Suttkus and G. H. Clemmer; **TU 47909**, 152 specimens from Alabama R. at Evans Upper Bar, river mi. 135.7, 26 September 1967, RDS 4204, collected by G. E. Gunning and A. Kuris; **TU 47924**, 105 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.8, 26 September 1967, RDS 4203, collected by R. D. Suttkus and G. H. Clemmer; **TU 47936**, 39 specimens from Alabama, Wilcox Cnty., Alabama R. at Reeves Bar, river mi. 128.5, 26 September 1967, RDS 4204, collected by R. D. Suttkus and G. H. Clemmer; **TU 47968**, 230 specimens from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.5, 27 September 1967, RDS 4207, collected by R. D. Suttkus and A. Kuris; **TU 47980**, 108 specimens from Alabama, Wilcox Cnty., Alabama R. at Wilcox Bar, river mi. 120.6, 27 September 1967, RDS 4208, collected by R. D. Suttkus and A. Kuris; **TU 47994**, 65 specimens from Alabama, Wilcox Cnty., Alabama R. at Ohio Bar, river mi. 111.7, 27 September 1967, RDS 4209, collected by R. D. Suttkus and A. Kuris; **TU 48012**, 232 specimens from Alabama, Monroe Cnty., Alabama R. at Stein Island, river mi. 107.5, 27 September 1967, RDS 4210, collected by R. D. Suttkus and G. H. Clemmer.

Notropis euryzonus Suttkus, 1955: 85.

PARATYPES: **TU 10700**, 8 specimens from Alabama, Russell Cnty., tributary to Little Uchee Cr., 1.1 mi. E of Crawford, U.S. Hwy. 80, 17 September 1955, RDS 2520, collected by R. D. Suttkus; **TU 10718**, 60 specimens from Alabama, Russell Cnty., tributary to Uchee Cr., 3.2 mi. W of Crawford, U.S. Hwy. 80, 17 September 1955, RDS 2521, collected by R. D. Suttkus.

Notropis gibbsi Howell & Williams, 1971: 55. (= *Cyprinella gibbsi*)

PARATYPES: **TU 61102**, 28 specimens from Alabama, Randolph Cnty., Wedowee Cr. on Alabama Hwy. 48, 0.5 mi. E of Wedowee, T20S, R11E, Sec. 2, 14 August 1964, collected by J. D. Williams and J. C. Hall.

Notropis hubbsi Bailey & Robison, 1978: 3.

PARATYPES: **TU 13956**, 7 specimens from Texas, Harrison Cnty., Caddo Lake, 1955; **TU 96238**, 31 specimens from Arkansas, Calhoun Cnty., Locust Bayou at Arkansas Hwy. 4 bridge, 0.5 mi. W of Locust Bayou, 20 May 1975, HWR 75-47, collected by H. W. Robison and S. Pelt.

Notropis hypsilepis Suttkus & Raney, 1955b: 161.

PARATYPES: **TU 8883**, 4 specimens from Georgia, Fulton Cnty., Vickery Cr. at junction with Chattahoochee R. at Roswell, U.S. Hwy. 19, 30 March 1950, ECR 1765 and RDS 1765, collected by E. C. Raney, R. D. Suttkus, C. R. Robins and R. Backus (removed from CU 17138); **TU 97111**, 8 specimens from Georgia, Habersham Cnty., Grant Cr., tributary to Soque R. near its junction with Chattahoochee R. near Cornelia, June 1949, collected by J. W. Colston (removed from CU 18102).

Notropis imeldae Cortes, 1966: 187.

PARATYPES: **TU 55375**, 5 specimens from México, Oaxaca, Río Atoyac at Juchatengo, 16°20′N, 97°05′W, 16 April 1965, collected by I. Martínez and L. Gonzáles (removed from series collected with holotype).

Notropis mekistocholas Snelson, 1971: 451.

PARATYPES: **TU 63272**, 7 specimens from North Carolina, Chatham Cnty., Rocky R. at North Carolina Hwy. 902 bridge, 7.0 air mi. SW of center of Pittsboro, 2 June 1968, FFS 68-31, collected by F. F. Snelson and W. M. Palmer (removed from NCSM 4928).

Notropis rafinesquei Suttkus, 1991: 1.

HOLOTYPE: **TU 157264**, from Mississippi, Carroll Cnty., Teoc Cr. at Mississippi Hwy. 35, R3E, T20N, Sec. 21, 12 May 1985, RDS 8758, collected by R. D. Suttkus and V. T. Colbert.

PARATYPES: **TU 140774**, 309 specimens collected with holotype; **TU 139610**, 750 specimens from Mississippi, Carroll Cnty., Teoc Cr. at Mississippi Hwy. 35, R3E, T20N, Sec. 21, 17 February 1985, RDS 8661, collected by R. D. Suttkus and K. G. Goodfellow; **TU 141302**, 50 specimens from Mississippi, Carroll Cnty., Aiken Cr. (at gravel road), R3E, T20N, Sec. 17, 22 June 1985, RDS 8795, collected by R. D. Suttkus; **TU 150052**, 97 specimens from Mississippi, Carroll Cnty., Teoc Cr. at Mississippi Hwy. 35, T20N, R3E, Sec. 21, 27 September 1987, RDS 9398, collected by R. D. Suttkus; **TU 155847**, 165 specimens from Mississippi, Carroll Cnty., Teoc Cr. at Mississippi Hwy. 35, 8 August 1989, RDS 9897, collected by R. D. Suttkus; **TU 158025**, 346 specimens from Mississippi, Carroll Cnty., Teoc Cr. at Mississippi Hwy. 35, 17 May 1990, RDS 10084, collected by R. D. Suttkus.

Notropis signipinnis Bailey & Suttkus, 1952: 1.

PARATYPES: **TU 1133**, 164 specimens from Mississippi, George Cnty., Maletts Spring Branch, tributary to Rocky Cr., tributary to Escatawpa R., 6.6 mi. SE of Lucedale, 4 June 1951, RDS 2147, collected by R. D. Suttkus and C. D. Hancock.

Notropis uranoscopus Suttkus, 1959: 7.

HOLOTYPE: **TU 15289**, from Alabama, Bibb Cnty., Cahaba R., 2.2 mi. N of Centerville, 17 March 1957, RDS 2594, collected by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. DeAbate.

PARATYPES: **TU 18551**, 18 specimens collected with holotype; **TU 18569**, 2 specimens from Alabama, Bibb Cnty., Cahaba R., 2 mi. S of Centerville, 5 July 1954, University of Alabama Number 406, collected by H. H. Howell, B. Brothers, R. Chermock, A. F. Hemphill, and H. T. Boschung; **TU 18570**, 8 specimens from Alabama, Bibb Cnty., Cahaba R., 2 mi. S of Centerville, 5 July 1954, collected by J. Mallory; **TU 18674**, 8 specimens from Alabama, Bibb Cnty., Cahaba R., 8.5 mi. N of Centerville, Hwy. 27 crossing, 8 July 1958, RDS 2738, collected by R. D. Suttkus, M. Andersson, S. Salisbury, and J DeAbate; **TU 19410**,

21 specimens from Alabama, Bibb Cnty., Cahaba R., 8.5 mi. N of Centerville, Hwy. 27 crossing, 8 September 1958, RDS 2760, collected by R. D. Suttkus and M. Andersson.

Phoxinus cumberlandensis Starnes & Starnes, 1978: 509.

HOLOTYPE: **TU 103312**, from Kentucky, Bell Cnty., Brownies Cr. along Kentucky Hwy. 987 at Cubage, 14 May 1975, collected by G. W. Wolfe and J. Lowe.

PARATYPES: **TU 103313**, 11 specimens from Kentucky, Bell Cnty., Brownies Cr. along Kentucky Hwy. 987, 8.5 km E of Cubage, 3 April 1976, collected by W. C. Starnes and L. B. Starnes; **TU 103314**, 6 specimens from Kentucky, Whitley Cnty., Archers Cr. at Cumberland Falls road, 5.4 km W of Kentucky Hwy. 204, 6 September 1976, collected by W. C. Starnes and L. B. Starnes; **TU 103315**, 1 specimen from Kentucky, Knox Cnty., Little Poplar Cr. at Cnty. Rd. 1809, 13.7 air km S of Barbourville, 24 September 1976, collected by T. Partin; **TU 103316**, 2 specimens (cleared and stained) from Kentucky, Bell Cnty., Brownies Cr. along Kentucky Hwy. 987, 8.5 km E of Cubage, 3 April 1976, collected by W. C. Starnes and L. B. Starnes; **TU 103317**, 3 specimens (cleared and stained) from Kentucky, Whitley Cnty., Youngs Cr. at gravel road, 0.8 km W of U.S. Hwy. 25W, 10.7 air km NW of Williamsburg, 6 September 1976, collected by W. C. Starnes and L. B. Starnes.

Phoxinus tennesseensis Starnes & Jenkins, 1988: 518.

HOLOTYPE: **TU 97993**, from Tennessee, Blount Cnty., spring seep tributary to Reed Cr., unnumbered cnty. rd., 5 mi. E of Tennessee Hwy. 73 (Walland), 6 June 1976, collected by W. C. Starnes, L. B. Starnes, and J. A. Loudon.

PARATYPES: **TU 97994**, 6 specimens collected with holotype; **TU (OC) 575**, 4 specimens from Tennessee, Roane Cnty., tributary to Bear Cr. at Tennessee Hwy. 95, 10 road km N of Clinch R. crossing, 15 February 1975, collected by W. C. Starnes and L. B. Starnes (cleared and stained).

Rhinichthys osculus moapae Williams, 1978: 513.

HOLOTYPE: **TU 103139**, from Nevada, Clark Cnty., Moapa R. at Anderson dairy farm, 1 May 1965, Nev. SoF 712, collected by J. E. Deacon.

PARATYPES: **TU 103140**, 3 specimens collected with holotype; **TU 103141**, 5 specimens from Nevada, Clark Cnty., Moapa R. at Lowhead Dam, 25 February 1967, collected by Vertebrate Zoology class.

Semotilus lumbee Snelson & Suttkus, 1978: 2.

HOLOTYPE: **TU 101095**, from North Carolina, Moore Cnty., fork of Aberdeen Cr. at culvert on U.S. Hwy. 1, 0.5 air mi. SW of center of Aberdeen, 8 May 1975, WMP 75-2, collected by W. M. Palmer, A. L. Braswell, and J. E. Cooper.

PARATYPES: **TU 101096**, 10 specimens collected with holotype; **TU 97877**, 13 specimens from North Carolina, Moore Cnty., fork of Aberdeen Cr. at culvert on U.S. Hwy. 1, 0.5 air mi. SW of center of Aberdeen, 12 May 1976, RDS 6148, collected by R. D. Suttkus and party.

Ictaluridae

Ictalurus serracanthus Yerger & Relyea, 1968: 373. (= *Ameiurus serracanthus*)

PARATYPES: **TU 22592**, 4 specimens from Florida, Gadsden Cnty., Lake Talquin just W of mouth of Little R., 20 October 1959, JMB 78, collected by J. M. Barkuloo and party; **TU 22642**, 1 specimen from Florida, Leon Cnty., Ochlockonee R. at Jackson Bluff, Florida Hwy. 20, 14-15 November 1959, RDS 2861, collected by R. D. Suttkus, J. M. Barkuloo, and E. Grover; **TU 37226**, 3 specimens from Florida, Wakulla Cnty., Sopchoppy R., 2.4 mi. S of Sopchoppy, U.S. Hwy. 319, 27 May 1964, collected by K. Relyea.

Noturus albater Taylor, 1969: 144.

PARATYPES: **TU 10180**, 1 specimen from Arkansas, Newton Cnty., Big Buffalo R., 15.8 mi. W of Jasper, Arkansas Hwy. 21, 30 April 1955, RDS 2485, collected by R. D. Suttkus, A. Harper, W. Hildebrand, and H. D. Hoese; **TU 12240**, 15 specimens from Arkansas, Washington Cnty., West Fork White R., 6.1 mi. S of Fayetteville, U.S. Hwy. 71, 2 September 1955, RDS 2509, collected by R. D. Suttkus; **TU 12258**, 85 specimens from Arkansas, Washington Cnty., White R., 8.3 mi. E of Springdale, Arkansas Hwy. 68, 3 September 1955, RDS 2512, collected by R. D. Suttkus; **TU 16553**, 35 specimens from Arkansas, Washington Cnty., White R., 8.3 mi. E of Springdale, Arkansas Hwy. 68, 4 October 1957, collected by R. D. Suttkus, C. F. Cole, J. DeAbate, S. Harvey, M. Andersson, and and B. I. Sundararaj; **TU 16575**, 12 specimens from Arkansas, Washington Cnty., White R., 8.3 mi. E of Springdale, Arkansas Hwy. 68, 5 October 1957, RDS 2667, collected by R. D. Suttkus, C. F. Cole, J. DeAbate, S. Harvey, M. Andersson, and B. I. Sundararaj; **TU 22401**, 7 specimens from Arkansas, Madison Cnty., War Eagle Cr., 5.4 mi. N of Huntsville, Arkansas Hwy. 23, 25 October 1959, RDS 2856, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj; **TU 22504**, 37 specimens from Arkansas, Newton Cnty., Buffalo Fork of White R., 15.5 mi. W of Jasper, Arkansas Hwy. 74, 24 October 1959, RDS 2853, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj; **TU 22514**, 2 specimens from Arkansas, Newton Cnty., Buffalo Fork of White R., 15.5 mi. W of Jasper, Arkansas Hwy. 74, 25 October 1959, RDS 2854, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj; **TU 22709**, 9 specimens from Arkansas, Cleburne Cnty., Devils Fork Little Red R. between Stark and Edgemont, 23 October 1959, RDS 2852, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj.

Noturus elegans Taylor, 1969: 150.

PARATYPES: **TU 19390**, 12 specimens from Kentucky, Green Cnty., Green R., 3.8 mi. ENE of Donnansburg, Kentucky Hwy. 88, 7 September 1958, RDS 2756, collected by R. D. Suttkus and M. Andersson; **TU 19460**, 16 specimens from Kentucky, Barren Cnty., tributary to Barren R., 2.6 mi. SW of Lucas, U.S. Hwy. 31E, at old mill dam, 7 September 1958, RDS 2757, collected by R. D. Suttkus and M. Andersson.

Noturus lachneri Taylor, 1969: 54.

PARATYPES: **TU 7074**, 1 specimen from Arkansas, Garland Cnty., 7.7 mi. SSW of Owensville, 3 mi. SE of U.S. Hwy. 70, 7 August 1953, EL 94, collected

by E. Liner; **TU 7077**, 2 specimens from Arkansas, Garland Cnty., 7.7 mi. SSW of Owensville, 3 mi. SE of U.S. Hwy. 70, 7 August 1953, EL 94, collected by E. Liner.

Noturus munitus Suttkus & Taylor, 1965: 171.

HOLOTYPE: **TU 26250**, from Mississippi, Marion Cnty., Pearl R., 2.6 mi. E of Sandy Hook, 14 November 1955, collected by R. D. Suttkus and K. T. Nielsen.

PARATYPES: **TU 11311**, 195 specimens collected with holotype; **TU 1844**, 23 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 24-25 November 1951, RDS 2207, collected by R. D. Suttkus and P. K. Anderson; **TU 3557**, 8 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 16 February 1952, RDS 2238, collected by R. D. Suttkus, P. K. Anderson, H. K. Suzuki, and T. Cain; **TU 3627**, 73 specimens from Mississippi, Marion Cnty., Pearl R., 4 mi. NE of Sandy Hook, 13 January 1952, RDS 2217, collected by R. D. Suttkus, P. K. Anderson, and W. D. Stone; **TU 3951**, 11 specimens from Mississippi, Marion Cnty., tributary to Pearl R., 4.8 mi. SE of Columbia, Mississippi Hwy. 13, 23 May 1952, RDS 2297, collected by R. D. Suttkus, T. Cain, and F. Sogandares-Bernal; **TU 4872**, 1 specimen from Mississippi, Marion Cnty., tributary to Pearl R., 4.3 mi. S of Foxworth, 19 August 1952, RDS 2173, collected by R. D. Suttkus, C. D. Hancock, and J. Black; **TU 7369**, 1 specimen from Louisiana, Washington Parish, Pushepatapa Cr., 0.8 mi. S of Varnado, 19 January 1952, RDS 2222, collected by R. D. Suttkus and H. K. Suzuki; **TU 8886**, 4 specimens from Mississippi, Marion Cnty., tributary to Pearl R., 0.5 mi. S of Hub or 8.5 mi. S of Columbia, 28 October 1950, RDS 2013, collected by R. D. Suttkus and C. L. Smith; **TU 9709**, 3 specimens from Mississippi, Marion Cnty., tributary to Pearl R., 5 mi. S of Columbia, 30 June 1954, RDS 2456, collected by R. D. Suttkus; **TU 10462**, 3 specimens from Louisiana, Washington Parish, Pushepatapa Cr., 0.8 mi. S of Varnado, 29 June 1954, RDS 2455, collected by R. D. Suttkus and K. T. Nielsen; **TU 11588**, 1 specimen from Louisiana, Washington Parish, Pushepatapa Cr., 8.2 mi. N of Bogalusa, 7 May 1956, RDS 2556, collected by R. D. Suttkus and Field Zoology class; **TU 13954**, 214 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 5 October 1956, RDS 2565, collected by R. D. Suttkus, R. J. Miller, and R. K. Chipman; **TU 14930**, 67 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 12-13 January 1957, RDS 2576, collected by R. D. Suttkus and R. J. Miller; **TU 14938**, 82 specimens from Mississippi, Marion Cnty., Pearl R., 2.6 mi. E. of Sandy Hook, 6 January 1957, RDS 2574, collected by R. D. Suttkus and R. J. Miller; **TU 15073**, 2 specimens from Louisiana, Washington Parish, Pushepatapa Cr., 1 mi. S of Varnado or 7 mi. N of Bogalusa, 13 January 1957, RDS 2578, collected by R. D. Suttkus and R. J. Miller; **TU 15171**, 92 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 22-23 January 1957, RDS 2580, collected by R. D. Suttkus and N. C. Negus; **TU 15465**, 2 specimens from Louisiana, Washington Parish, Pushepatapa Cr., 7 mi. N of Bogalusa, Hwy. 21, 21 April 1957, RDS 2600, collected by R. D. Suttkus, R. H. Gibbs, and party; **TU 16148**, 6 specimens from Mississippi, Marion Cnty., Ten Mile Cr., tributary to Pearl R., 9.7 mi. N of Sandy Hook, 7 August 1957, RDS 2641, collected by R. D. Suttkus and R. J. Miller; **TU 17472**, 1 specimen from Louisiana, Washington Parish, Pushepatapa Cr., 0.8 mi. S of Varnado, Louisiana Hwy. 21, 20 March 1958, RDS 2692,

collected by R. D. Suttkus, M. Andersson, and S. Harvey; **TU 17721**, 4 specimens from Mississippi, Simpson Cnty., Strong R., 2 mi. W of Pinola, 3 April 1958, RDS 2697, collected by R. D. Suttkus, J. S. Suttkus, and M. Andersson; **TU 17951**, 1 specimen from Mississippi, Marion Cnty., Ten Mile Cr., 10.4 mi. S of Columbia, Mississippi Hwy. 35, 3 May 1958, RDS 2711, collected by R. D. Suttkus, M. Andersson, and S. Simpson; **TU 18739**, 2 specimens from Mississippi, Simpson Cnty., Strong R., 2 mi. W of Pinola, Mississippi Hwy. 28 (formerly Hwy. 20), 3 July 1958, RDS 2735, collected by R. D. Suttkus, M. Andersson, and J. S. Suttkus; **TU 18963**, 60 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 3 November 1957, RJM 1053, collected by R. J. Miller, H. V. Miller, M. Andersson, and D. Boyer; **TU 19781**, 9 specimens from Mississippi, Simpson Cnty., Strong R., 2 mi. W of Pinola, Mississippi Hwy. 20, 8 May 1959, RDS 2774, collected by R. D. Suttkus and J. S. Suttkus; **TU 19825**, 52 specimens from Louisiana, Washington Parish, Bogue Chitto R., 1 mi. W of Warnerton, 2 May 1959, RDS 2770, collected by R. D. Suttkus, D. Landwehr, and L. Redman; **TU 19880**, 3 specimens from Louisiana, Washington Parish, Bogue Chitto R., 1 mi. W of Warnerton, 3 May 1959, RDS 2773, collected by R. D. Suttkus and Vertebrate Natural History class; **TU 22824**, 38 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 26 October 1959, RDS 2857, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj; **TU 23127**, 1 specimen from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 24 March 1960, RDS 2897, collected by R. D. Suttkus and G. E. Gunning; **TU 23310**, 1 specimen from Louisiana, Washington Parish, Bogue Chitto R., 1 mi. S of Enon, Louisiana Hwy. 437, 3 July 1960, RDS 2913, collected by R. D. Suttkus and J. S. Ramsey; **TU 23351**, 1 specimen from Louisiana, Washington Parish, Bogue Chitto R., 2 mi. W of Warnerton, Louisiana Hwy. 438, 3 July 1960, RDS 2914, collected by R. D. Suttkus and J. S. Ramsey; **TU 23518**, 24 specimens from Mississippi, Copiah Cnty., Copiah Cr., 2.4 mi. S of Georgetown, Mississippi Hwy. 27, 22 July 1960, RDS 2935, collected by R. D. Suttkus and J. S. Ramsey; **TU 23701**, 1 specimen from Mississippi, Marion Cnty., tributary to Pearl R., 0.5 mi N of Marion Cnty. line, 21 July 1960, RDS 2928, collected by R. D. Suttkus and J. S. Ramsey; **TU 23869**, 3 specimens from Mississippi, Copiah Cnty., Copiah Cr., 2.1 mi. S of Georgetown, Mississippi Hwy. 27, 25 November 1960, RDS 2940, collected by R. D. Suttkus and P. Menzies; **TU 26657**, 87 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 20 October 1961, JSR 61-95, collected by J. S. Ramsey and J. E. Thomerson; **TU 26695**, 1 specimen from Mississippi, Marion Cnty., Holiday Cr., 0.5 mi. S of Goss, Mississippi Hwy. 13, 21 October 1961, JSR 61-98, collected by J. S. Ramsey and J. E. Thomerson; **TU 26759**, 11 specimens from Mississippi, Lawrence Cnty., Fair R., 4.5 mi. N of Monticello, Mississippi Hwy. 27, 3 November 1961, JSR 61-104, collected by J. S. Ramsey and J. E. Thomerson; **TU 26878**, 1 specimen from Mississippi, Marion Cnty., Silver Cr. at N limits of Morgantown, Mississippi Hwy. 587, 9 December 1961, JSR 61-116, collected by J. S. Ramsey and J. E. Thomerson; **TU 27137**, 5 specimens from Mississippi, Lawrence Cnty., Pearl R., 2.5 mi. S Oakvale, 29 August 1962, RDS 3166, collected by R. D. Suttkus and J. S. Suttkus; **TU 27172**, 18 specimens from Mississippi, Marion Cnty., 1.5 mi. SE of Morgantown, 30 August 1962, RDS 3168, collected by R. D. Suttkus and J. S. Suttkus; **TU 27299**, 12 specimens from Mississippi, Lawrence Cnty., Bahala Cr., 6 mi. S of Rockport, Mississippi Hwy. 27, 28 October 1961, JSR 61-103, collected by J. S. Ramsey and J. E. Thomerson; **TU 28034**, 87 specimens from Mississippi,

Marion Cnty., Pearl R., 1.5 mi. SE of Foxworth, 1 December 1962, RDS 3187, collected by R. D. Suttkus and J. S. Suttkus; **TU 28272**, 47 specimens from Mississippi, Marion Cnty., Pearl R., 1.5 mi. SE of Foxworth, 17 October 1962, RDS 3172, collected by R. D. Suttkus and C. D. Barbour; **TU 28303**, 4 specimens from Mississippi, Marion Cnty., Pearl R., 3 mi. SE of Foxworth, 18 October 1962, RDS 3173, collected by R. D. Suttkus and C. D. Barbour; **TU 28316**, 13 specimens from Mississippi, Marion Cnty., Pearl R. above mouth of Ten Mile Cr., 6 mi. SE of Foxworth, 18 October 1962, RDS 3174, collected by R. D. Suttkus and C. D. Barbour; **TU 28345**, 10 specimens from Mississippi, Marion Cnty., Pearl R., 4 mi. NNE of Sandy Hook, 0.5 mi. upstream from mouth of Hurricane Cr., 18 October 1962, RDS 3175, collected by R. D. Suttkus and C. D. Barbour; **TU 28373**, 7 specimens from Mississippi, Marion Cnty., Pearl R., 2 mi. NE of Sandy Hook, 18 October 1962, RDS 3176, collected by R. D. Suttkus and C. D. Barbour; **TU 28391**, 23 specimens from Mississippi, Marion Cnty., Pearl R., 1.5 mi. NE of Sandy Hook, 19 October 1962, RDS 3177, collected by R. D. Suttkus and C. D. Barbour; **TU 28403**, 16 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. ESE of Sandy Hook, 19 October 1962, RDS 3178, collected by R. D. Suttkus and C. D. Barbour; **TU 28429**, 24 specimens from Louisiana, Washington Parish, Pearl R., 4 mi. E of Angie, 19 October 1962, RDS 3179, collected by R. D. Suttkus and C. D. Barbour; **TU 28534**, 240 specimens from Mississippi, Marion Cnty., Pearl R., 1.5 mi. SE of Foxworth, 19-20 December 1962, RDS 3188, collected by R. D. Suttkus and W. T. Mason; **TU 28719**, 30 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 21 October 1961, JSR 61-97, collected by J. S. Ramsey and J. E. Thomerson; **TU 28768**, 129 specimens from Mississippi, Marion Cnty., Pearl R., 2.3 mi. E of Sandy Hook, 28 December 1962, RDS 3191, collected by R. D. Suttkus and J. S. Ramsey; **TU 28820**, 14 specimens from Mississippi, Simpson Cnty., Strong R., 2 mi. W of Pinola, Mississippi Hwy. 28, 29 December 1962, RDS 3193, collected by R. D. Suttkus and J. S. Ramsey; **TU 29942**, 5 specimens from Louisiana, Washington Parish, Pearl R. just below sill at Pools Bluff, 4 mi. S of Bogalusa, 30-31 August 1963, collected by R. D. Suttkus and G. E. Gunning; **TU 29962**, 1 specimen from Louisiana, St. Tammany Parish, Pearl R. at river mi. 52, 0.2 mi. below mouth of McGehee Cr., 10 September 1963, RDS 3326, collected by R. D. Suttkus, J. S. Ramsey, and G. E. Gunning; **TU 29975**, 1 specimen from Louisiana, St. Tammany Parish, Pearl R. at river mi. 46, 10 September 1963, RDS 3328, collected by R. D. Suttkus, J. S. Ramsey, and G. E. Gunning; **TU 29989**, 1 specimen from Louisiana, St. Tammany Parish, West Pearl R., 5 mi. SE of Talisheek, 11 September 1963, RDS 3332, collected by R. D. Suttkus, J. S. Ramsey, and G. E. Gunning; **TU 30010**, 17 specimens from Louisiana, Washington Parish, Pearl R. just below sill at Pools Bluff, 4 mi. S of Bogalusa, 29 September 1963, RDS 3342, collected by R. D. Suttkus, J. S. Ramsey, and G. E. Gunning; **TU 30025**, 2 specimens from Louisiana, St. Tammany Parish, Pearl R., 0.2 mi. below mouth of McGehee Cr., 10 October 1963, RDS 3343, collected by R. D. Suttkus and G. E. Gunning; **TU 30040**, 2 specimens from Louisiana, Washington Parish, Pearl R. just below sill at Pools Bluff, 4 mi. S of Bogalusa, 25 October 1963, RDS 3353, collected by R. D. Suttkus and G. E. Gunning; **TU 30149**, 32 specimens from Mississippi, Simpson Cnty., Strong R. at rapids upstream of Mississippi Hwy. 28 bridge, 2 mi. W of Pinola, 6 November 1963, RDS 3357, collected by R. D. Suttkus and J. S. Ramsey.

Noturus phaeus Taylor, 1969: 100.

PARATYPES: **TU 3037**, 4 specimens from Mississippi, Lafayette Cnty , tributary to Yocona R., 5.1 mi. E of Yocona or 14.7 mi. E of Oxford, 23 May 1952, collected by R. D. Suttkus, T. Cain, and F. Sogandares-Bernal; **TU 3124**, 4 specimens from Mississippi, Lafayette Cnty., tributary to Yocona R., 8 mi. E of Oxford, Mississippi Hwy. 6, 24 May 1952 (incorrectly listed as TU 3134 in original description); **TU 3668**, 3 specimens from Mississippi, Lafayette Cnty., tributary to Yocona R., 7.0 mi. E of Oxford, "old" Mississippi Hwy. 6, 24 May 1952, collected by R. D. Suttkus, T. Cain, and F. Sogandares-Bernal (inadvertantly omitted from first type list); **TU 14014**, 1 specimen from Mississippi, Lafayette Cnty., Yocona R., 7.9 mi. SE of Oxford, Mississippi Hwy. 334, 12 July 1956, collected by G. H. Penn and J. B. Black; **TU 14024**, 1 specimen from Mississippi, Alcorn Cnty., 3 mi. N of Biggersville, U.S. Hwy. 45, 12 July 1956, collected by G. H. Penn and J. B. Black; **TU 14036**, 2 specimens from Mississippi, Benton Cnty., 0.3 mi. W of Michigan City, Mississippi Hwy. 7, 11 July 1956, collected by G. H. Penn and J. B. Black.

Noturus stanauli Etnier & Jenkins, 1980: 19.

HOLOTYPE: **TU 110929**, from Tennessee, Hancock Cnty., Clinch R. at Frost Ford, river mi. 181.1, 11.8 air km WSW of Kyles Ford, 21 April 1978, collected by D. L. Batch, B. H. Bauer, B. A. Branson, R. T. Bryant, D. A. Etnier, J. L. Harris, J. A. Louton, and M. G. Ryon.

PARATYPES: **TU 110930**, 5 specimens collected with holotype.

Noturus stigmosus Taylor, 1969: 173.

PARATYPES: **TU 19217**, 4 specimens from Michigan, Washtenaw Cnty., Huron R. at North Territorial Rd., 4 mi. NW of Dexter, 31 August 1958, RDS 2750, collected by R. D. Suttkus, C. R. Gilbert, and W. Davis; **TU 19246**, 6 specimens from Michigan, Washtenaw Cnty., Huron R. at North Territorial Rd., 4 mi. NW of Dexter, 3 September 1958, RDS 2752, collected by R. D. Suttkus, M. Andersson, and T. Poulson.

Noturus taylori Douglas, 1972: 785.

PARATYPES: **TU 69700**, 10 specimens from Arkansas, Montgomery Cnty., South Fork of the Caddo R., 1 mi. SE of Hopper and 0.5 mi. S of Arkansas Hwy. 240, 5 March 1971, collected by N. H. Douglas, D. W. Fruge, D. Heard, and J. Lindley (missing) (removed from NLU 18098).

Prietella phreatophila Carranza, 1954: 132.

PARATYPES: **TU 10810**, 4 specimens from Coahuila, México, "El Potrero" de Doña Mariana, Municipio de Múzquiz, at the base of Sierra de Santa Rosa, 29 August 1954, collected by J. Carranza and C. Bolivar (formerly in the series retained by J. Carranza at time of publication, subsequently sent to Tulane as a gift; one specimen removed, skeletonized and recataloged as TU (OC) 178).

Pimelodidae

Rhamdia luigiana Villa, 1977: 133.

PARATYPES: **TU 102026**, 3 specimens from Nicaragua, Depto. Granada, Lake Nicaragua between Ometepe and Zapatera Is., 11 m deep, 6 November 1976, JV 76-132, collected by J. Villa and crew of M/V Gaspar (removed from series collected with holotype).

Muraenidae

Gymnothorax kolpos Böhlke & Böhlke, 1980: 223.

PARATYPES: **TU 82455**, 2 specimens from Gulf of Mexico, 28°28′N, 90°00.3′W, 49 fms., 2 April 1973, JHC 73-315, collected by crew of R/V Oregon II cruise 44, W. W. Forman and J. H. Caruso.

Ophichthidae

Ophichthus rex Böhlke & Caruso, 1980: 239.

PARATYPES: **TU 82453**, 1 specimen from Gulf of Mexico, 28°28′N, 90°02′W, 45 fms., 2 April 1973, JHC 73-314, collected by crew of R/V Oregon cruise 44, W. W. Forman and J. H. Caruso; **TU 88498**, 1 specimen from Gulf of Mexico, Grand Isle Block 43, 28°59′N, 89°59′W, 96 ft., 1 March 1969, BAT 69-29, collected by B. A. Thompson; **TU 88499**, 1 specimen from Louisiana, St. Bernard Parish, Gulf of Mexico, East Bay area, East Delta Block 34, 135 ft., 3 August 1969, RJI 69-73, collected by R. J. Irwin; **TU 88500**, 1 specimen from Louisiana, Gulf of Mexico, 0.2 mi. W of Southwest Pass, 135 ft., 16 August 1969, RJI 69-79, collected by R. J. Irwin; **TU 88501**, 1 specimen from Louisiana, Gulf of Mexico, Grand Isle Block 43AA, 11 April 1970, JHC 70-14, collected by J. H. Caruso and B. A. Thompson; **TU 88502**, 1 specimen from Gulf of Mexico, 29°17.1′N, 88°58.9′W, 12 fms., 28 March 1973, JHC 73-286, collected by J. H. Caruso, W. W. Forman, and crew of R/V Oregon cruise 44; **TU 88505**, 1 specimen from Gulf of Mexico, 28°56.5′N, 88°05′W, 36 fms., 28 March 1973, JHC 73-289, collected by J. H. Caruso, W. W. Forman, and crew of R/V Oregon cruise 44; **TU 88506**, 1 specimen from Gulf of Mexico, 28°57′N, 89°39.2′W, 31 fms., 4 April 1973, JHC 73-322, collected by J. H. Caruso, W. W. Forman, and crew of R/V Oregon cruise 44; **TU 88507**, 1 specimen (skull only) from Gulf of Mexico, 29°09.2′N, 88°16.8′W, 200 fms., 8 May 1973, JHC 73-361, collected by J. H. Caruso and crew of R/V Oregon cruise 45; **TU 88508**, 1 specimen from Gulf of Mexico, 27°52.8′N, 90°53.1′W, 144-178 fms., 16 May 1973, JHC 73-286, collected by J. H. Caruso and crew of R/V Oregon cruise 45; **TU 88510**, 1 specimen from Gulf of Mexico, 28°21′N, 91°28′W, 34 fms., 7 December 1973, Oregon Sta. 14300, collected by Gutherz and crew of R/V Oregon cruise 48.

Cyprinodontidae

Cualac tessellatus Miller, 1956: 9.

PARATYPES: **TU 6557**, 32 specimens from San Luis Potosí, México, La Media Luna, about 7 mi. SSW of settlement of Ríoverde, collected by R. T. Gregg (removed from UMMZ 170948).

Cyprinodon labiosus Humphries & Miller, 1981: 55.

PARATYPES: **TU 111575**, 6 specimens from México, Lake Chichancanab, north end of North Pond, Yucatán, 27 July 1974, collected by J. M. Humphries and M. M. Stevenson (removed from UMMZ 201749).

Cyprinodon maya Humphries & Miller, 1981: 55.

PARATYPES: **TU 111576**, 5 specimens from México, Lake Chichancanab, lagoon on north side of road at Esmerelda, Yucatán, 27 July 1974, collected by J. M. Humphries and M. M. Stevenson (removed from UMMZ 201761).

Cyprinodon nazas Miller, 1976: 72.

PARATYPES: **TU 30616**, 26 specimens from Durango, México, tributary to Río del Peñon de Covadonga about 2 mi. SW of Peñon Blanco, 22 June 1963, CDB 63-10, collected by C. D. Barbour and S..Contreras.

Cyprinodon pecosensis Echelle & Echelle, 1978: 573.

HOLOTYPE: **TU 97127**, from New Mexico, Chaves Cnty., oxbow on Pecos R. at Bitter Lakes Wildlife Refuge, 4 April 1972, collected by A. A. Echelle and A. F. Echelle.

PARATYPES: **TU 97128**, 80 specimens collected with holotype; **TU 97026**, 248 specimens from Texas, Reeves Cnty., Salt Cr. at Farm Rd. 652 bridge, 16 August 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97030**, 12 specimens from New Mexico, Chaves Cnty., Salt Cr. Wilderness Area, single large sunken pothole, 2 June 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97033**, 30 specimens from New Mexico, Chaves Cnty., Comanche Draw, just inside entrance to Bottomless Lakes State Park, 2 April 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97037**, 46 specimens from Texas, Reeves Cnty., Salt Cr., U.S. Hwy. 285 bridge N of Orla, 28 March 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97039**, 88 specimens from New Mexico, Chaves Cnty., Figure-eight Lake, Bottomless Lakes State Park, April 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97042**, 81 specimens from New Mexico, Chaves Cnty., Bitter Lakes National Wildlife Refuge, pothole no. 2, 30 October 1970, collected by A. A. Echelle and A. F. Echelle; **TU 97043**, 51 specimens from New Mexico, Eddy Cnty., Pecos R. about 5 mi. SE of Malaga, 31 March 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97048**, 86 specimens from New Mexico, Chaves Cnty., mouth of Lost Cr., Bitter Lakes National Wildlife Refuge, unit no. 4 near spring, 4 March 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97049**, 23 specimens from New Mexico, Chaves Cnty., Cottonwood Spring, Bitter Lakes National Wildlife Refuge, 15 August 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97051**, 37 specimens from New Mexico, Chaves Cnty., Cottonwood Spring, upper end unit no. 4, Bitter Lakes National Wildlife Refuge, 18 November 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97053**, 91 specimens from New Mexico, Chaves Cnty., Bitter Lakes National Wildlife Refuge, last sinkhole with fish along road, 1 June 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97056**, 130 specimens from New Mexico, Chaves Cnty., isolated pool near spring at upper end unit no. 4, Bitter Lakes National Wildlife Refuge, 1 June 1971, collected by A. A. Echelle

and A. F. Echelle (incorrectly listed as TU 97057 in description); **TU 97066**, 41 specimens from New Mexico, Chaves Cnty., spring no. 1, upper end unit no. 4, Bitter Lakes National Wildlife Refuge, 15 August 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97070**, 50 specimens from Texas, Crane/Pecos Cnty. line, Pecos R., Farm Rd. 1053 N of Imperial, 26 March 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97081**, 120 specimens from New Mexico, Chaves Cnty., Bitter Lakes National Wildlife Refuge at upper end of unit no. 4, 1 June 1971, collected by A. A. Echelle and A. F. Echelle; **TU 97085**, 67 specimens from Texas, Pecos Cnty., ditch below Orient Reservoir dam, ranch road 2593, 26 March 1972, collected by A. A. Echelle and A. F. Echelle; **TU 97087**, 63 specimens from New Mexico, Chaves Cnty., Bottomless Lakes State Park, 28 October 1970, collected by A. A. Echelle and A. F. Echelle; **TU 97092**, 83 specimens from New Mexico, Chaves Cnty., Lazy Lagoon, Bottomless Lakes State Park, April 1972, collected by A. A. Echelle and A. F. Echelle.

Cyprinodon simus Humphries & Miller, 1981: 60.

PARATYPE: **TU 111577**, 1 specimen from México, Lake Chichancanab, lagoon on north side of road at Esmerelda, Yucatán, 27 July 1974, collected by J. M. Humphries and M. M. Stevenson (removed from UMMZ 201762).

Fundulus bifax Cashner & Rogers *in* Cashner, et al., 1988: 675.

PARATYPES: **TU 15280**, 3 specimens from Alabama, Elmore Cnty., Gold Branch, tributary to Channahatchee Cr., 6 mi. N of Eclectic, Alabama Hwy. 63, 16 March 1957, RDS 2592, collected by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. DeAbate; **TU 41114**, 9 specimens from Alabama, Elmore Cnty., Gold Branch, tributary to Channahatchee R., 6 mi. N of Eclectic, Alabama Hwy. 63, 12 April 1966, RDS 3873, collected by R. D. Suttkus and G. H Clemmer.

Fundulus euryzonus Suttkus & Cashner, 1981: 2.

HOLOTYPE: **TU 116631**, from Louisiana, Tangipahoa Parish, East Fork Big Cr., tributary to Tangipahoa R., at Louisiana Hwy. 1054, 4 March 1980, RDS 7283, collected by R. D. Suttkus, R. Reynolds, and J. Reynolds.

PARATYPES: **TU 116632**, 44 specimens collected with holotype; **TU 83182**, 40 specimens from Louisiana, Tangipahoa Parish, East Fork of Big Cr. 4.7 mi. E of Arcola, Louisiana Hwy. 1054, 10 March 1972, RDS 5180, collected by R. D. Suttkus and party; **TU 106576**, 22 specimens from Louisiana, Tangipahoa Parish, East Fork Big Cr., tributary to Tangipahoa R., at Louisiana Hwy. 1054, 27 March 1978, RDS 6672, collected by R. D. Suttkus, E. C. Beckham, W. M. Howell, and A. Black; **TU 106601**, 58 specimens from Louisiana, Tangipahoa Parish, East Fork Big Cr., tributary to Tangipahoa R., at Louisiana Hwy. 1054, 6.8 roadmi. E of Arcola, 27 March 1978, RDS 6673, collected by R. D. Suttkus, E. C. Beckham, W. M. Howell, and A. Black; **TU 116357**, 21 specimens from Louisiana, Tangipahoa Parish, East Fork of Big Cr. 4.7 mi. E of Arcola, Louisiana Hwy. 1054, 4 October 1974, RDS 5763, collected by R. D. Suttkus and R. Odom; **TU 116504**, 22 specimens from Louisiana, Tangipahoa Parish, East Fork of Big Cr. 4.9 mi. ENE of Arcola at Louisiana Hwy. 1054 bridge, 24 February 1980, RDS 7273, collected by R. D. Suttkus and R. C. Cashner; **TU 116597**, 42 specimens from Louisiana, Tangipahoa Parish, East Fork of Big Cr. 4.9 mi. ENE of

Arcola at Louisiana Hwy. 1054 bridge, 4 March 1980, RDS 7281, collected by R. D. Suttkus, R. Reynolds, and J. Reynolds.

Fundulus julisia Williams & Etnier, 1982:11.

PARATYPES: **TU 33495**, 1 specimen from Tennessee, Coffee Cnty., tributary to tributary to Hickory Cr., tributary to Collins R., 13.1 mi. SW of McMinnville, Tennessee Hwy. 55, 17 July 1964, JSR 64-69, collected by J. S. Ramsey and D. W. Walton; **TU 33511**, 3 specimens from Tennessee, Coffee Cnty., Little Duck R. at east limit of Manchester, Tennessee Hwy. 55, 17 July 1964, JSR 64-70, collected by J. S. Ramsey and D. W. Walton.

Xiphophorus marmorata Obregon & Contreras, 1988: 95.

PARATYPES: **TU 157267**, 2 specimens from Coahuila, México, El Socavón, 5.2 km SW of Múzquiz, Coahuila, 2 June 1978, SCB 78-18, collected by S. Contreras (removed from UANL 7275).

Caproidae

Antigonia combatia Berry & Rathjen, 1958: 255.

PARATYPES: **TU 18373**, 2 specimens from Atlantic Ocean, 07°31′N, 54°16′W, off Surinam, 125 fms., 8 November 1958, Oregon Sta. No. 2013, collected by crew of M/V Oregon.

Atherinidae

Atherinella ammophila Chernoff & Miller, 1984: 4.

PARATYPES: **TU 134878**, 3 specimens from Veracruz, México, Río de La Palma at La Palma, 1 January 1978, collected by W. W. Forman and M. Konikoff.

Chirostoma aculeatum Barbour, 1973: 130.

HOLOTYPE: **TU 40889**, from Guanajuato, México, south shore of Laguna de Yuriria about 1.5 mi. E of Yuriria, 1 August 1963, CDB 63-71, collected by C. D. Barbour and S. Contreras.

PARATYPES: **TU 40864**, 11 specimens collected with holotype.

Chirostoma riojai Solórzano & López, 1965b: 145.

PARATYPES: **TU 40173**, 2 specimens from México, México, Laguna de Santiago Tilapa, 31 October 1963, LB 1820, collected by A. Solórzano, R. Cruz, R. Aguilar, and F. Carmona.

Poblana ferdebueni Solórzano & López, 1965a: 209.

PARATYPES: **TU 38631**, 3 specimens from México, Puebla, Laguna de Almoloya o Chignahuapan, 22 May 1959, LB 951, collected by A. Solórzano and J. Obregón.

Serranidae

Pikea mexicanus Schultz, 1958: 323. (= *Bathyanthias mexicanus*)

PARATYPES: **TU 11004**, 6 specimens from Gulf of Mexico, 27°10′N, 96°20′W, 150 fms., 5 June 1954, Oregon Sta. 1094, collected by crew of M/V Oregon (gift to USNM); **TU 11008**, 1 specimen from Gulf of Mexico, 27° 10′N, 96°20′W, 150 fms., 5 June 1954, Oregon Sta. 1094, collected by crew of M/V Oregon; **TU 12972**, 11 specimens from Gulf of Mexico, 28°47′N, 85°19′W, 64 fms., 40 ft. flat trawl, 7 March 1953, Oregon Sta. 895, collected by crew of M/V Oregon; **TU 12985**, 1 specimen from Gulf of Mexico, 29°19′N, 86°04′W, 82 fms., 40 ft. trawl, 31 October 1953, Oregon Sta. 864, collected by crew of M/V Oregon; **TU 14739**, 1 specimen from Gulf of Mexico, 27°40′N, 95°45′W, 100 fms., 80 ft. balloon trawl, 7 May 1956, Oregon Sta. 1510, collected by crew of M/V Oregon.

Centrarchidae

Ambloplites ariommus Viosca, 1936: 37.

PARATYPES: **TU 2856**, 14 specimens from Louisiana, St. Tammany Parish, Little Bogue Falaya "Falia" Cr., 3 mi. N of Covington, 19 May 1935, collected by P. Viosca and G. H. Penn (formerly in the private collection of the late Percy Viosca; given to Tulane in 1955; specimens discolored green by copper eyelet of original label).

Ambloplites constellatus Cashner & Suttkus, 1977: 148.

HOLOTYPE: **TU 90909**, from Arkansas, Marion Cnty., Buffalo R. at mouth of Rush Cr., 5 mi. E of Arkansas Hwy. 14, 12 May 1972, RCC 72-492, collected by R. C. Cashner and J. M. Humphries.

PARATYPES: **TU 78124**, 5 specimens collected with holotype; **TU 43520**, 2 specimens from Arkansas, Baxter Cnty., Backwater Slough, 1 mi. below mouth of Buffalo R. on White R. side, 29 July 1965, VII-WR-65-lA, collected by R. C. Cashner and crew; **TU 44085**, 8 specimens from Arkansas, Baxter Cnty., White R., 0.5 mi. up from Buffalo City, 27 July 1965, XVII-WR-65-lB, collected by R. C. Cashner and crew; **TU 45418**, 1 specimen from Arkansas, Buffalo R. (general collection number 4), 21 July 1965, XXXIII-WR-65-lB, collected by R. C. Cashner and crew; **TU 46559**, 2 specimens from Arkansas, Searcy Cnty., Buffalo R. 1 mi. down from U.S. Hwy. 65 bridge, 19 August 1965, XXXV-WR-65-lA, collected by R. C. Cashner and crew; **TU 46611**, 11 specimens from Arkansas, Marion Cnty., Buffalo R., 1.5 mi. up from launch, 6 August 1965, XXXVIII-WR-65-3A, collected by R. C. Cashner and crew (incorrectly listed as 6 specimens in original description); **TU 49574**, 1 specimen from Arkansas, Baxter Cnty., Buffalo R. 3 mi. above its mouth near Buffalo City, 29 July 1966, VII-WR-66-15A, collected by R. C. Cashner and crew; **TU 51019**, 1 specimen from Arkansas, Baxter Cnty., Buffalo R., just above second riffle from confluence with White R., 6 November 1965, BR-P-lL, collected by Brown and party; **TU 51231**, 1 specimen from Arkansas, Baxter Cnty., 150 yards above second riffle up Buffalo R. from mouth, right side, 5 March 1966, BR-P-lR, collected by Brown and party; **TU 52445**, 2 specimens from Arkansas, Baxter Cnty., just above second riffle up Buffalo R. from its mouth, left side facing upstream, 13 August 1966, BR-P-lL, collected

by Brown and party; **TU 52564**, 1 specimen from Arkansas, Baxter Cnty., just above second riffle up Buffalo R. from its mouth, left side facing upstream, 12 September 1966, BR-P-1L, collected by Brown and party.

Elassoma boehlkei Rohde & Arndt, 1987: 66.

PARATYPES: **TU 144145**, 10 specimens from North Carolina, Brunswick Cnty., Juniper Cr. at North Carolina Hwy. 1340, 1.6 km E of Makatoka, 17.8 km NW of Supply, 13 February 1984, collected by F. C. Rohde.

Elassoma okatie Rohde & Arndt, 1987: 77.

PARATYPES: **TU 144146**, 11 specimens from South Carolina, Jasper Cnty., Causeway Swamp Cr. on U.S. Hwy. 17, 9.9 km N of Hardeville, 19 March 1984, collected by F. C. Rohde, R. G. Arndt, and S. A. George.

Sparidae

Calamus nodosus Randall & Caldwell, 1966: 36.

PARATYPE: **TU 37765**, 1 specimen from Atlantic Ocean off Georgia Coast, 33°42′N, 77°11′W, 12-20 fms., 9 December 1959, Silver Bay Sta. 1507, collected by crew of M/V Silver Bay.

Percidae

Ammocrypta bifascia Williams, 1975: 8.

HOLOTYPE: **TU 82632**, from Florida, Holmes Cnty., Choctawhatchee R. approximately 1.5 mi. W of Pittman, Florida Hwy. 2, T5N, R16W, Sec. 9, 5 July 1973, collected by J. D. Williams.

PARATYPES: **TU 82633**, 25 specimens collected with holotype; **TU 2278**, 4 specimens from Florida, Holmes Cnty., tributary to Choctawhatchee R., 3.5 mi. NW of junction Florida Hwys. 79 and 177, 28 May 1951, RDS 2100, collected by R. D. Suttkus and party (missing); **TU 20405**, 1 specimen from Florida, Holmes Cnty., Wrights Cr., 6.4 mi. N of Bonifay, Florida Hwy. 177, 12 July 1959, RDS 2804, collected by R. D. Suttkus, D. Landwehr, and J. S. Suttkus; **TU 20816**, 8 specimens from Florida, Holmes Cnty., Choctawhatchee R., 3 mi. S of Browns, Florida Hwy. 2, 24 July 1959, RDS 2821, collected by R. D. Suttkus, J. M. Barkuloo, E. Grover, and K. Byrd; **TU 37399**, 2 specimens from Alabama, Coffee Cnty., Cripple Cr., tributary to Pea R. 1.1 mi. N of Kinston, Alabama Hwy. 189, 23 April 1965, RDS 3653, collected by R. D. Suttkus and F. L. Rose; **TU 46129**, 2 specimens from Florida, Holmes Cnty., Wrights Cr., 3.8 mi. N of junction of Florida Hwys. 79 and 177 on Florida Hwy. 177N, 1 May 1967, LMJ 67-47, collected by L. M. Jones and party; **TU 46435**, 1 specimen from Florida, Holmes Cnty., Wrights Cr., 6.9 mi. N of junction of Florida Hwy. 79 and U.S. Hwy. 90, on Florida Hwy. 79N, 30 April 1967, LMJ 67-46, collected by L. M. Jones and party; **TU 82174**, 1 specimen from Florida, Holmes Cnty., Pittman Cr. on Florida Hwy. 177A, 2 mi. N of Florida Hwy. 2, 17 May 1973, RCC 565, collected by D. C. Heins, J. M. Humphries, and R. C. Cashner.

Ammocrypta meridana Williams, 1975: 21.

PARATYPES: **TU 29137**, 1 specimen from Alabama, Bibb Cnty., Cahaba R. about 7 mi. NE of Centerville, Hwy. 27 crossing, 17-18 July 1962, RDS 3132, collected by R. D. Suttkus and W. T. Mason; **TU 29914**, 7 specimens from Alabama, Perry Cnty., Cahaba R. about 1 mi. W of Sprott, Alabama Hwy. 14 or 5 mi. E of Marion, 15 April 1963, RDS 3232, collected by R. D. Suttkus, J. S. Ramsey, and M. D. Dahlberg; **TU 30080**, 1 specimen from Alabama, Perry Cnty., Cahaba R. about 5 mi. E of Marion, Alabama Hwy. 14 or 1 mi. W of Sprott, 2 November 1963, RDS 3355, collected by R. D. Suttkus and J. S. Ramsey; **TU 32565**, 2 specimens from Alabama, Monroe Cnty., Limestone Cr., tributary to Alabama R. 3.3 mi. NW of Monroeville, Alabama Hwy. 41, 30 May 1964, RDS 3454, collected by R. D. Suttkus and J. S. Ramsey; **TU 32590**, 1 specimen from Alabama, Monroe Cnty., Robinson Cr., tributary to Flat Cr. 3.9 mi. N of Tunnel Springs, Alabama Hwy. 47, 30 May 1964, RDS 3455, collected by R. D. Suttkus and J. S. Ramsey; **TU 35115**, 1 specimen from Alabama, Perry Cnty., Cahaba R. 2 mi. SW of Sprott, 26 June 1964, RDS 3505, R. D. Suttkus and Environmental Biology class; **TU 40420**, 7 specimens from Alabama, Monroe Cnty., Flat Cr., tributary to Alabama R., 8.7 mi. NW of Monroeville, Alabama Hwy. 41, 9 April 1966, RDS 3862, collected by R. D. Suttkus and G. H. Clemmer; **TU 41702**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 5 August 1966, RDS 3946, collected by R. D. Suttkus and G. E. Gunning; **TU 44436**, 23 specimens from Alabama, Monroe Cnty., Flat Cr., 8.6 mi. NW of Monroeville, Alabama Hwy. 41, 18 March 1967, RDS 4107, collected by R. D. Suttkus and Ichthyology class; **TU 44499**, 12 specimens from Alabama, Wilcox Cnty., Turkey Cr. 1.0 mi. S of Kimbrough, Alabama Hwy. 5, 18 March 1967, RDS 4108, collected by R. D. Suttkus and Ichthyology class; **TU 52497**, 1 specimen from Alabama, Perry-Dallas Cnty. line, 4.4 mi. N of junction of Alabama Hwys. 14 and 219 on Alabama Hwy. 219, 6 June 1968, collected by S. P. Marynick and M. C. Martin; **TU 52516**, 1 specimen from Alabama, Perry Cnty., Oakmulgee Cr., 9.9 mi. N of junction of Alabama Hwys. 14 and 219 on Alabama Hwy. 219, E 0.9 mi. on dirt road, 6 June 1968, collected by S. P. Marynick and M. C. Martin; **TU 53491**, 3 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 24 September 1968, TMB 78, collected by G. E. Gunning and T. M. Berra; **TU 58622**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.7, 11 August 1969, BAT 69-84, collected by G. E. Gunning and B. A. Thompson; **TU 58708**, 1 specimen from Alabama, Monroe Cnty., Alabama R. at mouth of Limestone Cr., 14 August 1969, RDS 4594, collected by R. D. Suttkus and G. E. Gunning; **TU 64600**, 17 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 24 September 1970, RDS 4846, collected by R. D. Suttkus and B. A. Thompson; **TU 65063**, 16 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 27-28 August 1970, RDS 4822, collected by R. D. Suttkus and R. C. Cashner; **TU 65080**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.7, 28 August 1970, RDS 4824, collected by R. D. Suttkus and G. E. Gunning; **TU 69108**, 3 specimens from Alabama, Bibb Cnty., Cahaba R., 8.4 mi. NNE of Centerville, Hwy. 27, 9 April 1971, RDS 4976, collected by R. D. Suttkus and party; **TU 70627**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.7, 1 August 1971, RDS 5051, collected by R. D. Suttkus and R. C. Cashner; **TU 70639**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Tait Bar,

river mi. 122.4, 1 August 1971, RDS 5052, collected by R. D. Suttkus and R. C. Cashner; **TU 71602**, 6 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 17 September 1971, RDS 5087, collected by R. D. Suttkus and B. A. Thompson; **TU 71616**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 17 September 1971, RDS 5088, collected by R. D. Suttkus and B. A. Thompson; **TU 71646**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.4, 17 September 1971, RDS 5090, collected by R. D. Suttkus and B. A. Thompson; **TU 78624**, 1 specimen from Alabama, Monroe Cnty., Alabama R. just below Haines Island, river mi. 94.8, 15 August 1972, RDS 5297, collected by R. D. Suttkus and G. E. Gunning; **TU 78647**, 1 specimen from Alabama, Monroe Cnty., Alabama R. at mouth of Flat Cr., river mi. 81.5, 16 August 1972, RDS 5299, collected by R. D. Suttkus and G. E. Gunning; **TU 79017**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Evans Lower Bar, river mi. 133, 14 September 1972, RDS 5312, collected by R. D. Suttkus and B. A. Thompson (incorrectly listed as 79016 in description); **TU 79037**, 7 specimens from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 14 September 1972, RDS 5311, collected by R. D. Suttkus and B. A. Thompson; **TU 79046**, 2 specimens from Alabama, Wilcox Cnty., Alabama R. at Yellow Jacket Bar, river mi. 129.7, 14 September 1972, RDS 5313, collected by R. D. Suttkus and B. A. Thompson; **TU 80065**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Evans Upper Bar, river mi. 135.7, 6 December 1972, RDS 5349, collected by R. D. Suttkus and R. C. Cashner; **TU 81501**, 1 specimen from Alabama, Wilcox Cnty., Alabama R. at Tait Bar, river mi. 122.4, 22 March 1973, RDS 5381, collected by R. D. Suttkus and party.

Etheostoma aquali Williams & Etnier, 1978: 464.

HOLOTYPE: **TU 105479**, from Tennessee, Bedford Cnty., Flat Cr., tributary to Duck R., at Tennessee Hwy. 64, 1 mi. SW of Shelbyville, 13 April 1967, collected by J. D. Williams and J. G. Armstrong.

PARATYPES: **TU 105480**, 1 specimen taken with holotype and cataloged as allotype; **TU 105481**, 3 specimens collected with holotype and cataloged as paratypes; **TU 32989**, 6 specimens from Tennessee, Bedford Cnty., Duck R. 13.4 mi. NW of Tullahoma, U.S. Hwy. 41A, 17 July 1964, JSR 64-72, collected by J. S. Ramsey and D. W. Walton (designated by Raney and Zorach (1967) and listed in Suttkus (1970) as paratypes of *Etheostoma microlepidum*); **TU 95729**, 1 specimen from Tennessee, Humphries Cnty., Duck R. just above mouth of Buffalo R., 10 September 1975, RDS 6024, collected by R. D. Suttkus and party.

Etheostoma blennius sequatchiense Burr, 1979: 198.

PARATYPE: **TU 33461**, 1 specimen from Tennessee, Sequatchie Cnty., Sequatchie R. 3.4 mi. S of Dunlap, U.S. Hwy. 127, 16 July 1964, JSR 64-67, collected by J. S. Ramsey and D.W. Walton.

Etheostoma boschungi Wall & Williams, 1974: 173.

HOLOTYPE: **TU 79424**, from Alabama, Lauderdale Cnty., Lindsey Cr. at junction Cnty. Rds. 15 and 6, 0.8 mi. N of Alabama Hwy. 20 at Central Heights, T1S, R12W, Sec. 3, 22 November 1969, collected by C. Gooch and J. D. Williams.

PARATYPES: **TU 79425**, 6 specimens collected with holotype; **TU 79426**, 6 specimens from Alabama, Madison Cnty., Copeland Branch, tributary to Briar Fork of Flint R., T1S, R1W, Sec. 26, 24 October 1970, collected by B. R. Wall and party; **TU 79427**, 15 specimens from Alabama, Lauderdale Cnty., Lindsey Cr. at junction Cnty. Rds. 15 and 6, 0.8 mi. N of Alabama Hwy. 20 at Central Heights, T1S, R12W, Sec. 3, 22 December 1971, collected by G. H. Clemmer and J. D. Williams.

Etheostoma brevirostrum Suttkus & Etnier, 1991: 15.

HOLOTYPE: **TU 158216**, from Alabama, Cleburne Cnty., Shoal Cr. at Pine Glen Recreation Area, 10 May 1989, RDS 9801, collected by R. D. Suttkus and J. M. Pierson.

PARATYPES: **TU 154765**, 6 specimens collected with holotype; **TU 56167**, 2 specimens from Alabama, Cleburne Cnty., Shoal Cr. at Pine Glen Recreation Area, 8.1 mi. N of Cleburne (U.S. Hwy. 78), 26 January 1969, RDS 4494, collected by R. D. Suttkus and B. A. Thompson; **TU 57896**, 1 specimen from Alabama, Calhoun Cnty., Shoal Cr. 2 mi. E of White Plains, 17 June 1969, RDS 4559, collected by R. D. Suttkus and J. S. Suttkus; **TU 59644**, 44 specimens from Alabama, Calhoun Cnty., Shoal Cr. tributary to Choccolocco Cr. on gravel road, 2.1 mi. E of White Plains, 14 October 1969, RDS 4641, collected by R. D. Suttkus, G. E. Gunning, B. A. Thompson, and R. C. Cashner; **TU 60351**, 5 specimens from Alabama, Cleburne Cnty., Shoal Cr. at Pine Glen Recreation Area, 8.1 mi. N of Cleburne (U.S. Hwy. 78), 16 October 1969, RDS 4648, collected by R. D. Suttkus, G. E. Gunning, B. A Thompson, and R. C. Cashner; **TU 60687**, 2 specimens from Alabama, Calhoun Cnty., Shoal Cr. at Whitesides Mill, 7 mi. NE of Choccolocco, October 1966, collected by W. M. Howell; **TU 66257**, 5 specimens from Alabama, Calhoun Cnty., Shoal Cr. tributary to Choccolocco Cr., 2.3 mi. E of White Plains on gravel road, 15 December 1970, BAT 70-33, collected by G. E. Gunning and B. A. Thompson; **TU 66556**, 1 specimen from Alabama, Calhoun Cnty., Choccolocco Cr. at Alabama Hwy. 9 bridge, 1 mi. S of White Plains, 15 December 1970, BAT 70-332, collected by G. E. Gunning and B. A. Thompson; **TU 68585**, 3 specimens from Alabama, Calhoun Cnty., Shoal Cr. 2.3 mi. E of White Plains, 17 March 1971, BAT 71-359, collected by G. E. Gunning and B. A. Thompson; **TU 74352**, 1 specimen from Alabama, Calhoun Cnty., Shoal Cr., tributary to Choccolocco Cr., 2.3 mi. E of White Plains, 7 December 1971, RCC 71-459, collected by R. C. Cashner and G. E. Gunning; **TU 152214**, 2 specimens from Alabama, Cleburne Cnty., Shoal Cr. at Pine Glen Recreation Area, 13 May 1988, RDS 9580, collected by R. D. Suttkus.

Etheostoma chlorobranchium Zorach, 1972: 431.

PARATYPES: **TU 26212**, 25 specimens from North Carolina, Swain Cnty., Oconaluftee R. at Ela, U.S. Hwy. 19, 19 July 1962, RDS 3138, collected by R. D. Suttkus, J. S. Ramsey, and W. T. Mason.

Etheostoma collettei Birdsong & Knapp, 1969: 106.

PARATYPES: **TU 52876**, 5 specimens from Louisiana, Union Parish, Meridian Cr., 1 mi. E of Conway, T22N, RlE, Sec. 17, 21 May 1956, collected by W. R. Taylor and L. W. Lowe. (A series of 10 uncataloged paratypes, with the same data as CU 52108, were apparently lost in transit to Tulane University).

Etheostoma crossopterum Braasch & Mayden, 1985: 15.

PARATYPES: **TU 139109**, 2 specimens from Tennessee, Wilson Cnty., Stones Cr. at gravel road just off Interstate 40 (Mt. Juliet exit), 12 May 1973, collected by D. A. Etnier and party (removed from UT 91.838).

Etheostoma ditrema Ramsey & Suttkus, 1965: 66.

HOLOTYPE: **TU 35703**, from Georgia, Chattooga Cnty., a spring flowing into a tributary to Mills Cr., tributary to Chattooga R., 4.3 air mi. due W of Lyerly, 18 July 1962, RDS 3134, collected by R. D. Suttkus and W. T. Mason.

PARATYPES: **TU 29153**, 21 specimens collected with holotype; **TU 26086**, 8 specimens from Georgia, Chattooga Cnty., spring tributary to Mills Cr., tributary to Chattooga R., 5.3 mi. W of Lyerly, 19 April 1962, RDS 3052, collected by R. D. Suttkus, J. S. Ramsey, J. E. Thomerson, and C. D. Barbour; **TU 27566**, 9 specimens from Georgia, Chattooga Cnty., spring tributary to Mills Cr., tributary to Chattooga R., 5.3 mi. W of Lyerly, 30 May 1962, JSR 62-57, collected by J. S. Ramsey; **TU 32762**, 34 specimens from Georgia, Chattooga Cnty., spring tributary to Chattooga R. 5.3 mi. W of Lyerly, 1 June 1964, RDS 3466, collected by R. D. Suttkus and J. S. Ramsey (inadvertently omitted from first type list); **TU 32981**, 43 specimens from Georgia, Chattooga Cnty., spring tributary to Mills Cr., tributary to Chattooga R., 5.3 mi. W of Lyerly, 23 June 1964, RDS 3499, collected by R. D. Suttkus and Environmental Biology class.

Etheostoma etnieri Bouchard, 1977: 107.

HOLOTYPE: **TU 83147**, from Tennessee, White Cnty., Cherry Cr. at Tennessee Hwy. 84, 18 March 1972, collected by R. W. Bouchard, J. D. Way, F. L. Oakberg, and B. E. Oakberg.

PARATYPES: **TU 83148**, 1 specimen collected with holotype and cataloged as allotype; **TU 83149**, 11 specimens collected with holotype and cataloged as paratypes; **TU 30316**, 2 specimens from Tennessee, Van Buren Cnty., Rocky R. 15 mi. E of McMinnville, Tennessee Hwy. 30, 11 April 1963, RDS 3220, collected by R. D. Suttkus, J. S. Ramsey, and M. D. Dahlberg; **TU 33451**, 1 specimen from Tennessee, Van Buren Cnty., Caney Cr., tributary to Caney Fork 5.4 mi. E of Spencer, Tennessee Hwy. 30, 16 July 1964, JSR 64-66, collected by J. S. Ramsey and D. W. Walton; **TU 33479**, 5 specimens from Tennessee, Warren Cnty., Collins R. 5.7 mi. ESE of McMinnville, Tennessee Hwy. 8, 17 July 1964, JSR 64-68, collected by J. S. Ramsey and D. W. Walton; **TU 83150**, 81 specimens from Tennessee, White Cnty., Wildcat Cr. at Cnty. Rd. 4396 off Tennessee Hwy. 84, E of Sparta, 7 October 1972, collected by J. Dewees.

Etheostoma flavum Etnier & Bailey, 1989: 3.

PARATYPES: **TU 30312**, 66 specimens from Tennessee, Coffee Cnty., Duck R. 2 mi. NW of Manchester, U.S. Hwy 41, 11 April 1963, RDS 3219, collected by R. D. Suttkus, J. S. Ramsey, and M. D. Dahlberg; **TU 139774**, 15 specimens from Tennessee, Houston Cnty., Big Richland Cr. at unnumbered gravel road, 5.8 km N of Waverly, 12 September 1981, collected by D. A. Etnier and party.

Etheostoma microlepidum Raney & Zorach, 1967: 94.

PARATYPES: **TU 19479**, 19 specimens from Tennessee, Rutherford Cnty., East Fork of Stones R., 6 mi. N of Murfreesboro, U.S. Hwy. 231, 7 September

1958, RDS 2758, collected by R. D. Suttkus and M. Andersson; **TU 32983**, 71 specimens from Tennessee, Cheatham Cnty., Harpeth R., 8 mi. E of White Bluff, U.S. Hwy. 70, 15 July 1964, JSR 64-60, collected by J. S. Ramsey and D. W. Walton.

Etheostoma moorei Raney & Suttkus, 1964: 131.

PARATYPES: **TU 22697**, 41 specimens from Arkansas, Cleburne Cnty., Devils Fork, Little Red R. between Stark and Edgemont, Arkansas Hwy. 16, 23 October 1959, RDS 2852, collected by R. D. Suttkus, M. Andersson, and B. I. Sundararaj; **TU 26227**, 22 specimens from Arkansas, Van Buren Cnty., Middle Fork, Little Red R. at Shirley, 17 August 1962, RDS 3157, collected by R. D. Suttkus and W. T. Mason; **TU 26249**, 21 specimens from Arkansas, Van Buren Cnty., South Fork, Little Red R., 9 mi. SW of Clinton, Arkansas Hwy. 95, 17 August 1962, RDS 3158, collected by R. D. Suttkus and W. T. Mason.

Etheostoma neopterum Howell & Dingerkus, 1978: 14.

PARATYPES: **TU 102024**, 7 specimens from Alabama, Lauderdale Cnty., small tributary to Little Butler Cr., about 2 mi. W of Pruitton, 3 April 1976, GD-AL-27-76, collected by G. Dingerkus, W. M. Howell, and A. Black.

Etheostoma nigripinne Braasch & Mayden, 1985: 28.

PARATYPES: **TU 139110**, 3 specimens from Tennessee, Decatur Cnty., Whites Cr., 4 mi. N of Bath Springs, 4 April 1978, collected by M. E. Braasch (removed from KU 20895).

Etheostoma nuchale Howell & Caldwell, 1965: 101.

PARATYPES: **TU 34591**, 20 specimens from Alabama, Jefferson Cnty., Glen Spring at Bessemer, T19S, R4W, Sec. 17, NE 1/4, along Cnty. Hwy. 20, 9 September 1964, RDS 3582, collected by R. D. Suttkus, J. S. Ramsey, and F. L. Rose.

Etheostoma olivaceum Braasch & Page, 1979: 2.

PARATYPES: **TU 101391**, 6 specimens from Tennessee, Putnam Cnty., Rock Springs Branch, 2 km N of Buffalo Valley, 11 December 1976, collected by B. M. Burr and L. M. Page (removed from INHS 75576).

Etheostoma pyrrhogaster Bailey & Etnier, 1988: 31.

PARATYPES: **TU 139772**, 4 specimens from Tennessee, Henry Cnty., Clear Cr., tributary to North Fork Obion R., at unnumbered cnty. rd., 1.7 air mi. S of Cnty. Rd. 8172, 3.2 air mi. SW of Puryear, 27 April 1972, collected by J. E. Deck, W. C. Dickinson, and J. Vaughn.

Etheostoma radiosum cyanorum Moore & Rigney, 1952: 10.

PARATYPES: **TU 10564**, 9 specimens from Oklahoma, Johnston Cnty., Blue R. at bridge, Oklahoma Hwy. 99, 14 June 1959, collected by G. A. Moore (formerly OAM (OSUS) 2913).

Etheostoma rubrum Raney & Suttkus, 1966: 95.

PARATYPES: **TU 30171**, 47 specimens from Mississippi, Copiah Cnty., Bayou Pierre, 8.6 mi. SW of Utica, Mississippi Hwy. 18, 7 December 1963, JSR 63-58, collected by J. S. Ramsey and M. D. Dahlberg; **TU 31341**, 2 specimens from Mississippi, Hinds Cnty., White Oak Cr., tributary to Bayou Pierre, 2.7 mi. S of Utica, Mississippi Hwy. 18, 1 February 1964, RDS 3378, collected by E. C. Raney and R. D. Suttkus; **TU 32264**, 11 specimens from Mississippi, Copiah Cnty., Bayou Pierre 18.7 mi. ENE of Port Gibson, Hwy. 18, 17 May 1964, RDS 3435, collected by R. D. Suttkus and J. S. Ramsey (inadvertently omitted from Suttkus (1970)); **TU 37305**, 4 specimens from Mississippi, Copiah Cnty., Bayou Pierre, 8.6 mi. SW of Utica, Mississippi Hwy. 18, 18 March 1965, RDS 3643, collected by R. D. Suttkus and L. Ogren; **TU 37451**, 53 specimens from Mississippi, Copiah Cnty., Bayou Pierre, 8.6 mi. SW of Utica, Mississippi Hwy. 18, 28 April 1965, RDS 3661, collected by R. D. Suttkus and F. L. Rose; **TU 40368**, 10 specimens from Mississippi, Copiah Cnty., Bayou Pierre, 8.6 mi. SW of Utica, Mississippi Hwy. 18, 2 April 1966, RDS 3855, collected by R. D. Suttkus and G. H. Clemmer.

Etheostoma smithi Page & Braasch, 1976: 2.

PARATYPES: **TU 95964**, 13 specimens from Kentucky, Livingston Cnty., Ferguson Cr., 3 km E of Smithland, 27 May 1971, collected by L. J. Stannard and L. M. Page.

Etheostoma striatulum Page & Braasch, 1977: 1.

PARATYPES: **TU 97493**, 10 specimens from Tennessee, Bedford Cnty., Wartrace Cr., 1 mi. E of Bell Buckle, 7 November 1975, collected by L. M. Page and M. E. Braasch (removed from INHS 75037).

Etheostoma tallapoosae Suttkus & Etnier, 1991: 3.

HOLOTYPE: **TU 158215**, from Alabama, Elmore Cnty., Gold Branch, tributary to Channahatchee Cr., 6 mi. N of Eclectic, Alabama Hwy. 63, 16 March 1957, RDS 2592, collected by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. DeAbate.

PARATYPES: **TU 15275**, 92 specimens collected with holotype; **TU 12084**, 4 specimens from Alabama, Elmore Cnty., Gold Branch, 6 mi. NE of Eclectic, Alabama Hwy. 63, 5 October 1955, RDS 2525, collected by R. D. Suttkus; **TU 29891**, 30 specimens from Alabama, Clay Cnty., Enitachope Cr., tributary to Hillabee Cr., 3.2 mi. SW of Ashland, Hwy. 9, 21 September 1963, JSR 63-46, collected by J. S. Ramsey; **TU 32737**, 21 specimens from Alabama, Clay Cnty., Enitachope Cr. 2.9 mi. S of Ashland, Alabama Hwy. 9, 1 June 1964, RDS 3462, collected by R. D. Suttkus and J. S. Ramsey; **TU 40656**, 57 specimens from Alabama, Clay Cnty., Enitachope Cr., tributary to Hillabee Cr., 2.9 mi. SW of Ashland, Alabama Hwy. 9, 13 April 1966, RDS 3877, collected by R. D. Suttkus and G. E. Gunning; **TU 41116**, 45 specimens from Alabama, Elmore Cnty., Gold Branch, tributary to Channahatchee Cr., 6 mi. N of Eclectic, Alabama Hwy. 63, 12 April 1966, RDS 3873, collected by R. D. Suttkus and G. H. Clemmer; **TU 41137**, 3 specimens from Alabama, Elmore Cnty., Channahatchee Cr., tributary

to Tallapoosa R., 2.5 mi. S of Red Hill, Alabama Hwy. 229, 12 April 1966, RDS 3874, collected by R. D. Suttkus and G. H. Clemmer; **TU 41160**, 12 specimens from Alabama, Clay Cnty., Hillabee Cr., tributary to Tallapoosa R., 1 mi. SW of Millerville, Alabama Hwy. 9, 13 April 1966, RDS 3876, collected by R. D. Suttkus and G. H. Clemmer; **TU 152230**, 7 specimens from Alabama, Elmore Cnty., Gold Branch, 0.9 mi. NW of Jordon, Alabama Hwy. 63, 14 May 1988, RDS 9581, collected by R. D. Suttkus; **TU 152243**, 15 specimens from Alabama, Elmore Cnty., Gold Branch, 1.7 mi. SE of Jordon, T20N, R21E, Sec. 29, 14 May 1988, RDS 9582, collected by R. D. Suttkus; **TU 157616**, 1 specimen from Alabama, Tallapoosa Cnty., Josie Leg Cr., 3.9 mi. SW of Perryville, Hwy. 22, 23 March 1990, RDS 10050, collected by R. D. Suttkus and J. M. Pierson; **TU 157633**, 11 specimens from Alabama, Elmore Cnty., Gold Branch, 6 mi. N of Eclectic, Alabama Hwy. 63, 23 March 1990, RDS 10051, collected by R. D. Suttkus and J. M. Pierson; **TU 157646**, 18 specimens from Alabama, Elmore Cnty., Gold Branch at Cnty. Rd. 357, 1.7 mi. SE of Alabama Hwy. 63 at Jordon, 23 March 1990, RDS 10052, collected by R. D. Suttkus and J. M. Pierson; **TU 157781**, 2 specimens from Alabama, Clay Cnty., Enitachope Cr., 2.8 mi. SSW of Ashland, Alabama Hwy. 9, 12 April 1990, RDS 10063, collected by R. D. Suttkus and J. M. Pierson; **TU 157793**, 19 specimens from Alabama, Elmore Cnty., Gold Branch 1.8 mi. E of Alabama Hwy. 63, 12 April 1990, RDS 10064, collected by R. D. Suttkus and J. M. Pierson; **TU 157803**, 4 specimens from Alabama, Elmore Cnty., Gold Branch, 6 mi. N of Eclectic, Alabama Hwy. 63, 12 April 1990, RDS 10065, collected by R. D. Suttkus and J. M. Pierson; **TU 158249**, 8 specimens from Alabama, Coosa Cnty., Oakachoy Cr. at Alabama Hwy. 259, T21N, R20E, Sec. 2, 9 August 1988, MP 88-79, collected by J. M. Pierson and C. Stephenson.

Etheostoma wapiti Etnier & Williams, 1989: 989.

PARATYPES: **TU 30271**, 1 specimen from Tennessee, Lincoln Cnty., Elk R. at Fayetteville, 0.25 mi. below U.S. Hwy. 231, 11 April 1963, RDS 3217, collected by R. D. Suttkus, J. S. Ramsey, and M. D. Dahlberg (missing); **TU 148010**, 2 specimens from Tennessee, Giles Cnty., Richland Cr. at Cnty. Rd. 4209 crossing, 11.2 air mi. SSE of Pulaski, 7 June 1982, collected by D. A. Etnier.

Etheostoma zonistium Bailey & Etnier, 1988: 39.

PARATYPES: **TU 139773**, 7 specimens from Tennessee, Hardin Cnty., Walker Branch, tributary to Mud Cr. at unnumbered cnty. rd., 3.1 air mi. SSW of Savannah, 16 May 1978, collected by D. A. Etnier and party.

Percina antesella Williams & Etnier, 1977: 7.

HOLOTYPE: **TU 94031**, from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 9-10 April 1970, collected by D. A. Etnier and party.

PARATYPES: **TU 58938**, 7 specimens from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 17 October 1969, RDS 4657, collected by R. D. Suttkus, B. A. Thompson, and R. C. Cashner; **TU 58968**, 3 specimens from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 19 October 1969, RDS 4660, collected by R. D. Suttkus, B. A. Thompson, and R. C. Cashner; **TU 59427**, 7 specimens from

Georgia, Murray Cnty., Conasauga R. 2.3 mi. W of junction Georgia Hwys. 225 and 286 on Georgia Hwy. 286, 19 October 1969, RDS 4661, collected by R. D. Suttkus, B. A. Thompson, and R. C. Cashner: **TU 65937**, 7 specimens from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 29 June 1970, RDS 4777, collected by R. D. Suttkus and R. C. Cashner; **TU 69143**, 8 specimens from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 15 April 1971, RDS 4989, collected by R. D. Suttkus and R. C. Cashner; **TU 78368**, 1 specimen from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 75, 12.9 mi. SE of Cleveland, 1 July 1972, BAT 72-451, collected by B. A. Thompson, D. A. Etnier, and University of Tennessee graduate students.

Percina aurolineata Suttkus & Ramsey, 1967: 129.

HOLOTYPE: **TU 39573**, from Georgia, Gilmer Cnty., Coosawattee R. about 200 yards below the mouth of a small spring tributary, 4.2 mi. SW of the center of Ellijay, 18 June 1966, RDS 3910, collected by R. D. Suttkus and Environmental Biology class.

PARATYPES: **TU 41049**, 3 specimens collected with holotype; **TU 38320**, 5 specimens from Georgia, Gilmer Cnty., Cartecay R., tributary to Coosawattee R., 2.9 mi. SE of Ellijay, along Georgia Hwy. 52, 18 June 1965, RDS 3695, collected by R. D. Suttkus and Environmental Biology class; **TU 38507**, 15 specimens from Georgia, Gilmer Cnty., Coosawattee R., 4.2 mi. SW of Ellijay, 22 June 1965, RDS 3707, collected by R. D. Suttkus and Environmental Biology class; **TU 40714**, 4 specimens from Georgia, Gilmer Cnty., tributary to Cartecay R., 2.9 mi. SE of Ellijay, along Georgia Hwy. 52, 15 April 1966, RDS 3881, collected by R. D. Suttkus and G. H. Clemmer; **TU 41053**, 6 specimens from Georgia, Gilmer Cnty., Cartecay R., 3.1 mi. SE of Ellijay, along Georgia Hwy. 52, 17 June 1966, RDS 3909, collected by R. D. Suttkus, G. H. Clemmer, and Environmental Biology class.

Percina caprodes fulvitaenia Morris & Page, 1981: 96.

PARATYPES: **TU 110587**, 2 specimens from Missouri, Osage Cnty., Maries R., 2 km S of Westphalia, 11 October 1969, collected by P. W. Smith and L. M. Page (removed from INHS 75634).

Percina gymnocephala Beckham, 1980: 1.

HOLOTYPE: **TU 106911**, from North Carolina, Ashe Cnty., South Fork of New R. at E crossing of Cnty. Rd. 1181, 7.0 air mi. SE of West Jefferson, 22 September 1977, ECB 344, collected by E. C. Beckham and E. B. Beckham.

PARATYPES: **TU 105137**, 3 specimens from North Carolina, Ashe Cnty., South Fork of New R. at E crossing of Cnty. Rd. 1181, 7.0 air mi. SE of West Jefferson, 22 September 1977, ECB 344, collected by E. C. Beckham and E. B. Beckham; **TU 70059**, 3 specimens from Virginia, Grayson Cnty., Fox Cr. along Cnty. Rd. 711, 1.4 mi. above Fox, junction Cnty. Rd. 711 and U.S. Hwy. 58, 13 June 1971, BAT 71-379, collected by B. A. Thompson and K. Thompson; **TU 70102**, 12 specimens from Virginia, Grayson Cnty., Fox Cr. at U.S. Hwy. 58 bridge, 3.0 mi. NE of [town of] Mouth Of Wilson, 12 June 1971, BAT 71-377,

collected by B. A. Thompson and K. Thompson; **TU 71144**, 3 specimens from Virginia, Grayson Cnty., Fox Cr. along Cnty. Rd. 711, 1.2 mi. NW of Fox (U.S. Hwy. 58), 13 June 1971, BAT 71-381, collected by B. A. Thompson and K. Thompson; **TU 105084**, 2 specimens from Virginia, Grayson Cnty., Fox Cr. at U.S. Hwy. 58, 3 mi. E of [town of] Mouth Of Wilson, 20 September 1977, ECB 339, collected by E. C. Beckham and E. B. Beckham; **TU 105124**, 1 specimen from North Carolina, Ashe Cnty., South Fork of New R. at North Carolina Hwy. 163, 7.5 air mi. SE of West Jefferson, 22 September 1977, ECB 343, collected by E. C. Beckham and E. B. Beckham; **TU 106912**, 2 specimens from North Carolina, Ashe Cnty., South Fork of New R. at Cnty. Rd. 1105 bridge, 0.1 mi. S of Cnty. Rd. 1106, 24 March 1978, HLB 18, collected by H. L. Bart, R. Holzenthal, J. M. Grady, and G. Laiche.

Percina jenkinsi Thompson, 1985: 4.

HOLOTYPE: **TU 106075**, from Tennessee, Bradley Cnty., Conasauga R. at Tennessee Hwy. 74 bridge, 12.6 mi. SE of Cleveland, 1 July 1972, BAT 72-451, collected by B. A. Thompson, D. A. Etnier, and University of Tennessee graduate students.

PARATYPES: **TU 78370**, 2 specimens collected with holotype (incorrectly listed as TU 78369 in original description); **TU 69140**, 6 specimens from Tennessee, Bradley Cnty., Conasauga R., 12.6 mi. SE of Cleveland, Tennessee Hwy. 74, 15 April 1971, RDS 4989, collected by R. D. Suttkus and R. C. Cashner; **TU 80506**, 1 specimen from Tennessee, Bradley Cnty., Conasauga R., 12.9 mi. SE of Cleveland, Tennessee Hwy. 74, 29 June 1970, RDS 4777, collected by R. D. Suttkus and R. C. Cashner; **TU 80507**, 6 specimens from Tennessee, Bradley Cnty., Conasauga R., 12.7 mi. SE of Cleveland, Tennessee Hwy. 74, 17 October 1969, RDS 4657, collected by R. D. Suttkus, B. A. Thompson, and R. C. Cashner; **TU 80508**, 8 specimens from Tennessee, Bradley Cnty., Conasauga R., 12.7 mi. SSE of Cleveland, Tennessee Hwy. 74, 19 October 1969, RDS 4660, collected by R. D. Suttkus, B. A. Thompson, and R. C. Cashner.

Percina lenticula Richards & Knapp, 1964: 695.

PARATYPES: **TU 15291**, 7 specimens from Alabama, Bibb Cnty., Cahaba R., 2.2 mi. N of Centerville, just off Alabama Hwy. 5, 17 May 1957, RDS 2594, collected by R. D. Suttkus, R. J. Miller, H. V. Miller, and J. DeAbate.

Percina tanasi Etnier, 1976: 473.

HOLOTYPE: **TU 90858**, from Tennessee, Loudon Cnty., Little Tennessee R. at shoal area out from mouth of Coytee Springs, 6 November 1973, BAT 73-564, collected by B. A. Thompson, D. A. Etnier, W. C. Starnes, G. F. Boronow, B. F. Clark, and R .L. Hensen.

PARATYPES: **TU 83994**, 2 specimens collected with holotype; **TU 90859**, 1 specimen from Tennessee, Loudon Cnty., Little Tennessee R. at shoal area out from mouth of Coytee Springs, 6 November 1973, BAT 73-564, collected by B. A. Thompson, D. A. Etnier, W. C. Starnes, G. F. Boronow, B. F. Clark, and R. L. Hensen.

Poecilichthys whipplii radiosus Hubbs & Black, 1941: 10. (elevated to *Etheostoma radiosum* by Moore and Rigney, 1952)

PARATYPES: **TU 52871**, 1 specimen from Arkansas, Garland Cnty., North Fork, Ouachita R., 2.5 mi. W of Buckville, 1 June 1939, collected by T. Holder; **TU 52872**, 5 specimens from Arkansas, Garland Cnty., Cataract Branch, 2.75 mi. N of Cedar Glade, 2 May 1939, collected by T. Holder; **TU 52873**, 2 specimens from Arkansas, Garland Cnty., Big Branch, 2.25 mi. W of Buckville, 16 May 1939, collected by T. Holder. (These eight paratypes apparently had been retained at the University of Arkansas by John D. Black subsequent to the description. During 1967, a large part of the University of Arkansas fish collection was given to Tulane University and thus the transfer of the type material).

Lutjanidae

Symphysanodon berryi Anderson, 1970: 338.

PARATYPES: **TU 57443**, 2 specimens from Atlantic Ocean, 20°45′N, 73°33′W, 217-200 fms., 24 May 1965, Oregon Sta. 5414, collected by crew of M/V Oregon (removed from series of 43 specimens from same station as holotype).

Cichlidae

Cichlasoma pantostictum Taylor & Miller, 1983: 15.

PARATYPES: **TU 5640**, 3 specimens from Tamaulipas, México, Laguna de Chairel at the mouth of Río Tamesi at Tampico, 29 December 1952, RMD X-23, collected by J. H. Darnell and E. Liner.

Clinidae

Starksia y-lineata Gilbert, 1965: 2.

PARATYPES: **TU 36401**, 2 specimens from Caribbean Sea, Grand Cayman Island, "Ironshore" formation in front of Seaview Lodge, S side of Georgetown, depth 2-12 ft., collected by C. R. Gilbert and J. C. Tyler.

Microdesmidae

Microdesmus carri Gilbert, 1966: 326.

PARATYPES: **TU 36400**, 2 specimens from Atlantic Ocean, Costa Rica, Limon Province, E side of Tortuguero Lagoon, near mouth, 7 August 1964, collected by D. P. Kelso (removed from UF 11297).

Microdesmus suttkusi Gilbert, 1966: 329.

HOLOTYPE: **TU 25110**, from Costa Rica, Puntarenas Province, Boca de Río Baru at Dominical, 28 January 1961, RDS 2961, collected by R. D. Suttkus, A. Smalley, and party.

PARATYPES: **TU 25130**, 1 specimen from Costa Rica, Puntarenas Province, Río Baru, 1 km N of Dominical, 28 January 1961, RDS 2962, collected by R. D.

Suttkus, A. Smalley, and party; **TU 25262**, 1 specimen from Costa Rica, Puntarenas Province, at La Barca, 27 February 1960, collected by S. Jimenez-C.

Fierasferidae (=Carapidae)

Echiodon dawsoni Williams & Shipp, 1982: 846.

PARATYPES: **TU 122841**, 2 specimens from Gulf of Mexico, 29°39.8′N, 87°16.2′W, 75.6 m, 7 February 1978, collectors unknown (removed from USAIC 6006).

Draconettidae

Draconetta oregona Briggs & Berry, 1959: 129.

PARATYPES: **TU 18831**, 3 specimens from Atlantic Ocean, 02°04′N, 47°00′W, 125 fms., 17 November 1957, Oregon Sta. 2080, collected by crew of M/V Oregon (incorrectly listed as TU 188831 in description) (removed from series collected with holotype).

Gobiidae

Gobiosoma evelynae Böhlke & Robins, 1968: 103.

PARATYPES: **TU 48782**, 2 specimens from Atlantic Ocean, Virgin Islands, Anguilla Island, Dowlings Shoal, W of Crocus Bay off N end of Sand Island, 17 July 1965, collected by J. C. Tyler and W. N. Eschmeyer (formerly ANSP 110549).

Gobiosoma genie Böhlke & Robins, 1968: 109.

PARATYPES: **TU 48781**, 1 specimen from Atlantic ocean, Bahama Islands, Hog Island, north shore (station 122), 15 March 1953, collected by C. C. G. Chaplin.

Triglidae

Bellator ribeiroi Miller, 1965: 259.

PARATYPES: **TU 37821**, 2 specimens from Atlantic Ocean off Colombia, 08°50.5′N, 76°53.5′W, 37-40 fms., 27 May 1964, Oregon Sta. 4899, collected by crew of M/V Oregon.

Peristedion greyae Miller, 1967: 27.

PARATYPES: **TU 33302**, 2 specimens from Atlantic Ocean off North Carolina, 34°15′N, 75°54′W, 190-200 fms., 9 June 1962, Silver Bay Sta. 4159, collected by crew of M/V Silver Bay.

Cottidae

Cottus carolinae infernatis Williams & Robins, 1970: 371.

PARATYPES: **TU 32497**, 5 specimens from Alabama, Clarke Cnty., Big

Reedy Cr., tributary to Alabama R., 7 mi. NE of Carlton, 28 May 1964, RDS 3450, collected by R. D. Suttkus and J. S. Ramsey.

Cottus pygmaeus Williams, 1968: 334.

PARATYPES: **TU 34396**, 47 specimens from Alabama, Calhoun Cnty., Coldwater Cr., just below Coldwater Springs at town of Coldwater, 31 August 1964, RDS 3571, collected by R. D. Suttkus and J. S. Ramsey.

Tetraodontidae

Sphoeroides parvus Shipp & Yerger, 1969: 478.

PARATYPES: **TU 9381**, 1 specimen from Louisiana, St. Tammany Parish, Lake Ponchartrain, 2 mi. W of south drawbridge of Louisville and Nashville Railroad, 30°10′N, 89°55′W, 5 November 1954, M/V Anna Inez Station 547, collected by R. D. Suttkus and party; **TU 19038**, 2 specimens from Louisiana, Cameron Parish, at jetties along west bank of Calcasieu R. at Cameron, 28 April 1957, RFS 7, collected by R. F. Smith and M. Guidry; **TU 22573**, 14 specimens from Louisiana, Jefferson Parish, Gulf of Mexico, 100 yards off Grand Terre Island near Grand Isle, 12 December 1959, collected by D. Landwehr and R. D. Lumsden.

Batrachoididae

Porichthys bathoiketes Gilbert, 1968: 710.

PARATYPES: **TU 18572**, 9 specimens from Atlantic Ocean, 11°27′N, 83°11′W, 135 fms., 9 September 1957, Oregon Sta. 1902, collected by crew of M/V Oregon; **TU 18573**, 1 specimen from Atlantic Ocean, 16°07′N, 81°05′W, 130 fms., 24 August 1957, Oregon Sta. 1891, collected by crew of M/V Oregon; **TU 18574**, 3 specimens from Atlantic Ocean, 16°38′N, 81°39′W, 150 fms., 22 August 1957, Oregon Sta. 1879, collected by crew of M/V Oregon; **TU 19928**, 2 specimens from Atlantic Ocean, 16°39′N, 81°43′W, 125 fms., 22 August 1957, Oregon Sta. 1878, collected by crew of M/V Oregon.

Lophiidae

Lophiodes bruchius Caruso, 1981: 539.

PARATYPES: **TU 94331**, 3 specimens from Hawaii, Pacific Ocean, 21°03.5′N, 156°29.1′W, 274-318 m, 25 November 1968, TC 40-92, collected by crew of R/V Townsend Cromwell; **TU 94332**, 2 specimens from Hawaii, Pacific Ocean, 21°04.5′N, 156°27.5′W, 337-340 m, 22 November 1968, TC 40-74, collected by crew of R/V Townsend Cromwell.

Lophiodes reticulatus Caruso & Suttkus, 1979: 491.

PARATYPES: **TU 2733**, 1 specimen from Gulf of Mexico, 29°49′N, 85°45′W, 112 fms., 24 February 1950, Oregon Sta. 278, collected by crew of M/V Oregon; **TU 90215**, 1 specimen from Gulf of Mexico, 29°15.7′N, 88°09′W, 70 fms., 3 May 1973, JHC 73-344, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso; **TU 94027**, 3 specimens from Gulf of Mexico, 28°47′N, 85°19′W, 64 fms., 7 March 1953, Oregon Sta. 895, collected by crew of M/V Oregon.

Chaunacidae

Chaunax suttkusi Caruso, 1989: 160.

PARATYPES: **TU 2811**, 2 specimens from Gulf of Mexico, 29°20′N, 87°25′W, 315 fms., 28 April 1951, Oregon Sta. 319, collected by crew of M/V Oregon; **TU 10947**, 5 specimens from Gulf of Mexico, 24°20′N, 83°24′W, 180 fms., 13 April 1954, Oregon Sta. 1007, collected by crew of M/V Oregon; **TU 12660**, 12 specimens from Gulf of Mexico, 26°24′N, 83°45′W, 210 fms., 19 June 1956, Oregon Sta. 1556, collected by crew of M/V Oregon; **TU 35837**, 6 specimens from Gulf of Mexico, 24°28′N, 83°27′W, 205 fms., 6 August 1963, Oregon Sta. 4371, collected by crew of M/V Oregon and M. D. Dahlberg; **TU 90284**, 1 specimen from Gulf of Mexico, 29°16.1′N, 87°38′W, 250 fms., 4 May 1973, JHC 73-348, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso; **TU 90324**, 2 specimens from Gulf of Mexico, 29°14.5′N, 87°44′W, 270 fms., 5 May 1973, JHC 73-351, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso; **TU 90381**, 1 specimen from Gulf of Mexico, 29°01.8′N, 88°14.9′W, 400 fms., 6 May 1973, JHC 73-356, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso; **TU 90461**, 2 specimens from Gulf of Mexico, 24°28.7′N, 83°32.5′W, 200 fms., 21 May 1973, JHC 73-371, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso; **TU 90473**, 1 specimen from Gulf of Mexico, 24°23.4′N, 83°24.1′W, 220 fms., 21 May 1973, JHC 73-372, collected by crew of R/V Oregon II cruise 45 and J. H. Caruso.

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Literature Cited

Anderson, W. D. 1970. Revision of the genus *Symphysanodon* (Pisces: Lutjanidae) with descriptions of four new species. Fishery Bull. 68: 325-346.

Bailey, R. M. and D. A. Etnier. 1988. Comments on the subgenera of darters (Percidae) with descriptions of two new species of *Etheostoma (Ulocentra)* from southeastern United States. Misc. Pub. Mus. Zool. Univ. Michigan 175: 1-48.

Bailey, R. M. and H. W. Robison. 1978. *Notropis hubbsi*, a new cyprinid fish from the Mississippi River basin, with comments on *Notropis welaka*. Occ. Pap. Mus. Zool. Univ. Michigan 683: 1-21.

Bailey, R. M. and R. D. Suttkus. 1952. *Notropis signipinnis*, a new cyprinid fish from southeastern United States. Occ. Pap. Mus. Zool. Univ. Michigan 542: 1-15.

Barbour, C. D. 1973. The systematics and evolution of the genus *Chirostoma* Swainson (Pisces, Atherinidae). Tulane Stud. Zool. Bot. 18: 97-141.

Barbour, C. D. and S. Contreras. 1968. *Algansea monticola*, a new cyprinid fish from the Pacific slope of central México. Proc. Biol. Soc. Washington 81: 101-108.

Barbour, C. D. and R. R. Miller. 1978. A revision of the Mexican cyprinid genus *Algansea*. Misc. Pub. Mus. Zool. Univ. Michigan 155: 1-72.

Beckham, E. C., III. 1980. *Percina gymnocephala*, a new percid fish of the subgenus *Alvordius*, from the New River in North Carolina, Virginia, and West Virginia. Occ. Pap. Mus. Zool. Louisiana State Univ. 57: 1-11.

Berg, L. S. 1940. Classification of Fishes both Recent and Fossil (English and Russian). J. W. Edwards, Publisher, Inc., Ann Arbor, Michigan.

Berry, F. H. and W. F. Rathjen. 1958. A new species of the boarfish genus *Antigonia* from the western Atlantic. Quart. J. Florida Acad. Sci. 21: 255-258.

Birdsong, R. S. and L. W. Knapp. 1969. *Etheostoma collettei*, a new darter of the subgenus *Oligocephalus* from Louisiana and Arkansas. Tulane Stud. Zool. Bot. 15: 106-112.

BÖHLKE, J. E. and E. B. BÖHLKE. 1980. The identity of the moray, *Gymnothorax conspersus* Poey, and the description of *G. kolpos*, n. sp., from the western Atlantic Ocean. Proc. Acad. Nat. Sci. Philadelphia 132: 218-227.

BÖHLKE, J. E. and J. H. CARUSO. 1980. *Ophichthus rex*: a new giant snake eel from the Gulf of Mexico (Anguilliformes, Ophichthidae). Proc. Acad. Nat. Sci. Philadelphia 132: 239-244.

BÖHLKE, J. E. and C. R. ROBINS. 1968. Western Atlantic seven-spined gobies, with descriptions of ten new species and a new genus, and comments on Pacific relatives. Proc. Acad. Nat. Sci. Philadelphia 120: 45-174.

BOUCHARD, R. W. 1977. *Etheostoma etnieri*, a new percid fish from the Caney Fork (Cumberland) River system, Tennessee, with a redescription of the subgenus *Ulocentra*. Tulane Stud. Zool. Bot. 19: 105-130.

BRAASCH, M. E. and L. M. PAGE. 1979. Systematic studies of darters of the subgenus *Catonotus* (Percidae), with the description of a new species from Caney Fork, Tennessee. Occ. Pap. Mus. Nat. Hist. Univ. Kansas 78: 1-10.

BRAASCH, M. E. and R. L. MAYDEN. 1985. Review of the subgenus *Catonotus* (Percidae) with descriptions of two new darters of the *Etheostoma squamiceps* species group. Occ. Pap. Mus. Nat. Hist. Univ. Kansas 119: 1-83.

BRIGGS, J. C. and F. H. BERRY. 1959. The Draconettidae—a review of the family with the description of a new species. Copeia 1959: 123-133.

BURR, B. M. 1979. Systematics and life history aspects of the percid fish *Etheostoma blennius* with description of a new subspecies from Sequatchie River, Tennessee. Copeia 1979: 191-203.

BURR, B. M. and R. C. CASHNER. 1983. *Campostoma pauciradii*, a new cyprinid fish from southeastern United States, with a review of related forms. Copeia 1983: 101-116.

CARRANZA, J. 1954. Descripción del primer bagre anoftalmo y depigmentado encontrado en aguas mexicanas. Ciencia 14: 129-136.

CARUSO, J. H. 1981. The systematics and distribution of the lophiid anglerfishes: I. A revision of the genus *Lophiodes* with the description of two new species. Copeia 1981: 522-549.

CARUSO, J. H. 1989. Systematics and distribution of the Atlantic chaunacid anglerfishes (Pisces: Lophiiformes). Copeia 1989: 153-165.

CARUSO, J. H. and R. D. SUTTKUS. 1979. A new species of lophiid angler fish from the western North Atlantic. Bull. Mar. Sci. 29: 491-496.

CASHNER, R. C., J. S. ROGERS, and J. M. GRADY. 1988. *Fundulus bifax*, a new species of the subgenus *Xenisma* from the Tallapoosa and Coosa River systems of Alabama and Georgia. Copeia 1988: 674-683.

CASHNER, R. C. and R. D. SUTTKUS. 1977. *Ambloplites constellatus*, a new species of rock bass from the Ozark upland of Arkansas and Missouri with a review of western rock bass populations. Amer. Midl. Nat. 98: 147-161.

CHERNOFF, B. and R. R. MILLER. 1984. *Atherinella ammophila*, a new atherinid fish from eastern Mexico. Notulae Naturae 462: 1-12.

CLEMMER, G. H. and R. D. SUTTKUS. 1971. *Hybopsis lineapunctata*, a new cyprinid fish from the upper Alabama River system. Tulane Stud. Zool. Bot. 17: 21-30.

CONTRERAS, S. and R. RIVERA. 1973. *Notropis aguirrepeqeñoi*, especie nueva endemica del Río Soto La Marina, Tamaulipas, México (Pisces: Cyprinidae). Publ. Inst. Inv. Cient., Univ. Auton. Nuevo Léon, México 1: 9-23.

CONTRERAS, S. and J. VERDUZCO. 1977. *Dionda mandibularis*, a new cyprinid fish endemic to the upper Río Verde, San Luis Potosí, México, with comments on related species. Trans. San Diego Soc. Nat. Hist. 18: 259-266.

CORTES, M. T. 1966. Consideraciones sobre el género *Notropis* y descripción de una especie nueva, procendente del Río Atoyac en Juchatengo, Oax., México. An. Esc. Nac. Cienc. Biol. 15: 185-192.

DOUGLAS, N. H. 1972. *Noturus taylori*, a new species of madtom (Pisces: Ictaluridae) from the Caddo River, southwest Arkansas. Copeia 1972: 785-789.

ECHELLE, A. A. and A. F. ECHELLE. 1978. The Pecos River pupfish, *Cyprinodon pecosensis* n. sp. (Cyprinodontidae), with comments on its evolutionary origin. Copeia, 1978: 569-582.

ETNIER, D. A. 1976. *Percina (Imostoma) tanasi*, a new percid fish from the Little Tennessee River, Tennessee. Proc. Biol. Soc. Washington 88: 469-488.

ETNIER, D. A. and R. M. BAILEY. 1989. *Etheostoma (Ulocentra) flavum*, a new darter from the Tennessee and Cumberland River drainages. Occ. Pap. Mus. Zool. Univ. Michigan 717: 1-24.

ETNIER, D. A. and R. E. JENKINS. 1980. *Noturus stanauli*, a new madtom catfish (Ictaluridae) from the Clinch and Duck Rivers, Tennessee. Bull. Alabama Mus. Nat. Hist. 5: 17-22.

ETNIER, D. A. and J. D. WILLIAMS. 1989. *Etheostoma (Nothonotus) wapiti* (Osteichthyes: Percidae), a new darter from the southern bend of the Tennessee River system in Alabama and Tennessee. Proc. Biol. Soc. Washington 102: 987-1000.

GIBBS, R. H., Jr. 1960. *Alepisaurus brevirostris*, a new species of lancet fish from the western North Atlantic. Breviora 123: 1-14.

GILBERT, C. R. 1965. *Starksia y-lineata*, a new clinid fish from Grand Cayman Island, British West Indies. Notulae Naturae 379: 1-6.

GILBERT, C. R. 1966. Two new wormfishes (family Microdesmidae) from Costa Rica. Copeia 1966: 325-332.

GILBERT, C. R. 1968. Western Atlantic batrachoidid fishes of the genus *Porichthys*, including three new species. Bull. Mar. Sci. 18: 671-730.

HILDEBRAND, S. F. 1948. A review of the American menhaden, genus *Brevoortia*, with a description of a new species. Smithson. Misc. Coll. 107: 1-39.

HOWELL, W. M. and R. D. CALDWELL. 1965. *Etheostoma (Oligocephalus) nuchale*, a new darter from a limestone spring in Alabama. Tulane Stud. Zool. 12: 101-108.

HOWELL W. M. and G. DINGERKUS. 1978. *Etheostoma neopterum*, a new percid fish from the Tennessee River system in Alabama and Tennessee. Bull. Alabama Mus. Nat. Hist. 3: 13-26.

HOWELL, W. M. and J. D. WILLIAMS. 1971. *Notropis gibbsi*, a new cyprinid fish from the Tallapoosa River system in Alabama and Georgia. Copeia 1971: 55-64.

HUBBS, C. L. and J. D. BLACK. 1941. The subspecies of the American percid fish, *Poecilichthys whipplii*. Occ. Pap. Mus. Zool. Univ. Michigan 429: 1-27.

HUMPHRIES, J. M. and R. R. MILLER. 1981. A remarkable species flock of pupfishes, genus *Cyprinodon*, from Yucatan, México. Copeia 1981: 52-64.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE (Editorial Committee). 1985. International Code of Zoological Nomenclature: Adopted by the XX General Assembly of the International Union of Biological Sciences. International Trust for Zoological Nomenclature, London.

LACHNER, E. A. and R. E. JENKINS. 1967. Systematics, distribution and evolution of the chub genus *Nocomis* (Cyprinidae) in the southwestern Ohio River basin, with the description of a new species. Copeia 1967: 557-580.

LACHNER, E. A. and R. E. JENKINS. 1971a. Systematics, distribution, and evolution of the chub genus *Nocomis* Girard (Pisces: Cyprinidae) of eastern United States, with descriptions of new species. Smithson. Contrib. Zool. 85: 1-97.

LACHNER, E. A. and R. E. JENKINS. 1971b. Systematics, distribution, and evolution of the *Nocomis biguttatus* species group (family Cyprinidae: Pisces) with a description of a new species from the Ozark uplands. Smithson. Contrib. Zool. 91: 1-28.

LACHNER, E. A. and M. L. WILEY. 1971. Populations of the polytypic species *Nocomis leptocephalus* (Girard) with a description of a new subspecies. Smithson. Contrib. Zool. 92: 1-35.

LEVITON, A. E., R. H. GIBBS, JR., E. HEAL, and C. E. DAWSON. 1985. Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1985: 802-832.

LOZANO, M. DE L. and S. CONTRERAS. 1990 *Astyanax armandoi*, n. sp. from Chiapas, México (Pisces, Ostariophysi: Characidae) with a comparison to the nominal species *A. aeneus* and *A. mexicanus*. Universidad y Ciencia 7: 95-107.

MAYDEN, R. L. 1988. Systematics of the *Notropis zonatus* species group, with description of a new species from the interior highlands of North America. Copeia 1988: 153-173.

MAYDEN, R. L. and B. R. KUHAJDA. 1989. Systematics of *Notropis cahabae*, a new cyprinid fish endemic to the Cahaba River of the Mobile basin. Bull. Alabama Mus. Nat. Hist. 9: 1-16.

MEAD, G. W. 1958. Three new species of archibenthic iniomous fishes from the western North Atlantic. J. Washington Acad. Sci. 48: 362-372.

MILLER, G. C. 1965. A new species of searobin (Triglidae). Quart. J. Florida Acad. Sci. 28: 259-266.

MILLER, G. C. 1967. A new species of western Atlantic armored searobin, *Peristedion greyae* (Pisces: Peristediidae). Bull. Mar. Sci. 17: 16-41.

MILLER, R. R. 1956. A new genus and species of cyprinodontid fish from San Luis Potosi, México, with remarks on the subfamily Cyprinodontinae. Occ. Pap. Mus. Zool. Univ. Michigan 581: 1-17.

MILLER, R. R. 1976. Four new pupfishes of the genus *Cyprinodon* from México, with a key to the *C. eximius* complex. Bull. S. California Acad. Sci. 75: 68-75.

MOORE, G. A. and C. C. RIGNEY. 1952. Taxonomic status of the percid fish *Poecilichthys radiosus* in Oklahoma and Arkansas, with the descriptions of two new subspecies. Copeia 1952: 7-15.

MORRIS, M. A. and L. M. PAGE. 1981. Variation in western logperches (Pisces: Percidae), with a description of a new subspecies. Copeia 1981: 95-108.

OBREGON, H. and S. CONTRERAS. 1988. Una nueva especie de pez del genero *Xiphophorus* del grupo *couchianus* en Coahuila, México (Poeciliidae). Publ. Biol. Facultad Cien. Biol. Univ. Auton. Nuevo León 2: 93-124.

PAGE, L. M. and M. E. BRAASCH. 1976. Systematic studies of darters of the subgenus *Catonotus* (Percidae), with the description of a new species from the lower Cumberland and Tennessee River systems. Occ. Pap. Mus. Nat. Hist. Univ. Kansas 60: 1-18.

PAGE, L. M. and M. E. BRAASCH. 1977. Systematic studies of darters of the subgenus *Catonotus* (Percidae), with the description of a new species from the Duck River system. Occ. Pap. Mus. Nat. Hist. Univ. Kansas 63: 1-18.

RAMSEY, J. S. and R. D. SUTTKUS. 1965. *Etheostoma ditrema*, a new darter of the subgenus *Oligocephalus* (Percidae) from springs of the Alabama River basin in Alabama and Georgia. Tulane Stud. Zool. 12: 65-77.

RANDALL, J. E. and D. K. CALDWELL. 1966. A review of the sparid fish genus *Calamus*, with descriptions of four new species. Bull. Los Angeles County Mus. Nat. Hist. Sci. 2: 1-47.

RANEY, E. C. and R. D. SUTTKUS. 1964. *Etheostoma moorei*, a new darter of the subgenus *Nothonotus* from the White River system, Arkansas. Copeia 1964: 130-139.

RANEY, E. C. and R. D. SUTTKUS. 1966. *Etheostoma rubrum*, a new percid fish of the subgenus *Nothonotus* from Bayou Pierre, Mississippi. Tulane Stud. Zool. 13: 95-102.

RANEY, E. C. and T. ZORACH. 1967. *Etheostoma microlepidum*, a new percid fish of the subgenus *Nothonotus* from the Cumberland and Tennessee River systems. Amer. Midl. Nat. 77: 93-103.

RICHARDS, W. J. and L. W. KNAPP. 1964. *Percina lenticula*, a new percid fish, with a redescription of the subgenus Hadropterus. Copeia 1964: 690-701.

ROHDE, F. C. and R. G. ARNDT. 1987. Two new species of pygmy sunfishes (Elassomatidae, *Elassoma*) from the Carolinas. Proc. Acad. Nat. Sci. Philadelphia 139: 65-85.

SCHULTZ, L. P. 1958. Three new serranid fishes, genus *Pikea*, from the western Atlantic. Proc. U.S. Nat. Mus. 108: 321-329.

SHIPP, R. L. and R. W. YERGER. 1969. A new puffer fish, *Sphoeroides parvus*, from the western Gulf of Mexico, with a key to species of *Sphoeroides* from the Atlantic and Gulf Coasts of the United States. Proc. Biol. Soc. Washington 82: 477-488.

SNELSON, F. F. 1971. *Notropis mekistocholas*, a new herbivorous cyprinid fish endemic to the Cape Fear River basin, North Carolina. Copeia 1971: 449-462.

SNELSON, F. F. 1972. Systematics of the subgenus *Lythrurus*, genus *Notropis* (Pisces: Cyprinidae). Bull. Florida State Mus., Biol. Sci. 17: 1-92.

SNELSON, F. F. and R. D. SUTTKUS. 1978. A new species of *Semotilus* (Pisces: Cyprinidae) from the Carolinas. Bull. Alabama Mus. Nat. Hist. 3: 1-11.

SOLORZANO, A. and Y. LOPEZ. 1965a. Nueva especie de *Poblana* capturada en la Laguna de Almoloya Chignahuapan, Estado de Puebla (México). Ciencia 23: 209-213.

SOLORZANO, A. and Y. LOPEZ. 1965b. Nueva especie de *Chirostoma* capturada en la Laguna de Victoria de Santiago Tilapa, Estado de México (Pisc., Atherin.). Ciencia 24: 145-150.

STARNES, W. C. and R. E. JENKINS. 1988. A new cyprinid fish of the genus *Phoxinus* (Pisces: Cypriniformes) from the Tennessee River drainage with comments on relationships and biogeography. Proc. Biol. Soc. Washington 101: 517-529.

STARNES, W. C. and L. B. STARNES. 1978. A new cyprinid of the genus *Phoxinus* endemic to the upper Cumberland River drainage. Copeia 1978: 508-516.

SUTTKUS, R. D. 1955. *Notropis euryzonus*, a new cyprinid fish from the Chattahoochee River system of Georgia and Alabama. Tulane Stud. Zool. 3: 83-100.

SUTTKUS, R. D. 1959. *Notropis uranoscopus*, a new cyprinid fish from the Alabama River system. Copeia 1959: 7-11.

SUTTKUS, R. D. 1970. Type specimens of fishes in the Tulane University collection with a brief history of the collection. Tulane Stud. Zool. Bot. 16: 116-130.

SUTTKUS, R. D. 1980. *Notropis candidus*, a new cyprinid fish from the Mobile Bay basin, and a review of the nomenclatural history of *Notropis shumardi*. Bull. Alabama Mus. Nat. Hist. 5: 1-15.

SUTTKUS, R. D. 1991. *Notropis rafinesquei*, a new cyprinid fish from the Yazoo River system in Mississippi. Bull. Alabama Mus. Nat. Hist. 10: 1-9.

SUTTKUS, R. D. and H. T. BOSCHUNG. 1990. *Notropis ammophilus*, a new cyprinid fish from southeastern United States. Tulane Stud. Zool. Bot. 27: 49-63.

SUTTKUS, R. D. and R. C. CASHNER. 1981. A new species of cyprinodontid fish, genus *Fundulus (Zygonectes)*, from Lake Pontchartrain tributaries in Louisiana and Mississippi. Bull. Alabama Mus. Nat. Hist. 6: 1-17.

SUTTKUS, R. D. and G. H. CLEMMER. 1968. *Notropis edwardraneyi*, a new cyprinid fish from the Alabama and Tombigbee River systems and a discussion of related species. Tulane Stud. Zool. Bot. 15: 18-39.

SUTTKUS, R. D. and D. A. ETNIER. 1991. *Etheostoma tallapoosae* and *E. brevirostrum*, two new darters, subgenus *Ulocentra*, from the Alabama River drainage. Tulane Stud. Zool. Bot. 28: 1-24.

SUTTKUS, R. D. and J. S. RAMSEY. 1967. *Percina aurolineata*, a new percid fish from the Alabama River system and a discussion of ecology, distribution, and hybridization of darters of the subgenus *Hadropterus*. Tulane Stud. Zool. 13: 129-145.

SUTTKUS, R. D. and E. C. RANEY. 1955a. *Notropis baileyi*, a new cyprinid fish from the Pascagoula and Mobile Bay drainages of Mississippi and Alabama. Tulane Stud. Zool. 2: 69-86.

SUTTKUS, R. D. and E. C. RANEY. 1955b. *Notropis hypsilepis*, a new cyprinid fish from the Apalachicola River system of Georgia and Alabama. Tulane Stud. Zool. 2: 159-170.

SUTTKUS, R. D. and E. C. RANEY. 1955c. *Notropis asperifrons*, a new cyprinid fish from the Mobile Bay drainage of Alabama and Georgia, with studies of related species. Tulane Stud. Zool. 3: 1-33.

SUTTKUS, R. D. and W. R. TAYLOR. 1965. *Noturus munitus*, a new species of madtom, family Ictaluridae, from southern United States. Proc. Biol. Soc. Washington 78: 169-178.

TAYLOR, J. N. and R. R. MILLER. 1983. Cichlid fishes (genus *Cichlasoma*) of the Río Ranuco basin, eastern México, with description of a new species. Occ. Pap. Mus. Nat. Hist. Univ. Kansas 104: 1-24.

TAYLOR, W. R. 1969. A revision of the catfish genus *Noturus* Rafinesque with an analysis of higher groups in the Ictaluridae. Bull. Nat. Mus. 282: 1-315.

THOMERSON, J. E. and S. H. WEITZMAN. 1970. A new species of glandulocaudine characid fish, *Hysteronotus myersi*, from Peru. Proc. California Acad Sci., 4th Series, December 31, 1970.

THOMPSON, B. A. 1985. *Percina jenkinsi*, a new species of logperch (Pisces: Percidae) from the Conasauga River, Tennessee and Georgia. Occ. Pap. Mus. Zool. Louisiana State Univ. 61: 1-23.

VILLA, J. 1977. A new species of pimelodid catfish of the genus *Rhamdia* from Nicaragua, Central America. Brenesia 12/13: 133-142.

VIOSCA, P., JR. 1936. A new rock bass from Louisiana and Mississippi. Copeia 1936: 37-45.

WALL, B. R., JR. and J. D. WILLIAMS. 1974. *Etheostoma boschungi*, a new percid fish from the Tennessee River drainage in northern Alabama and western Tennessee. Tulane Stud. Zool. Bot. 18: 172-182.

WILLIAMS, J. D. 1968. A new species of sculpin, *Cottus pygmaeus*, from a spring in the Alabama River basin. Copeia 1968: 334-342.

WILLIAMS, J. D. 1975. Systematics of the percid fishes of the subgenus *Ammocrypta*, genus *Ammocrypta*, with descriptions of two new species. Bull. Alabama Mus. Nat. Hist. 1: 1-56.

WILLIAMS, J. D. and G. H. CLEMMER. 1991. *Scaphirhynchus suttkusi*, a new sturgeon (Pisces: Acipenseridae) from the Mobile basin of Alabama and Mississippi. Bull. Alabama Mus. Nat. Hist. 10: 17-31.

WILLIAMS, J. D. and D. A. ETNIER. 1977. *Percina (Imostoma) antesella*, a new percid fish from the Coosa River system in Tennessee and Georgia. Proc. Biol. Soc. Washington 90: 6-18.

WILLIAMS, J. D. and D. A. ETNIER. 1978. *Etheostoma aquali*, a new percid fish (subgenus *Nothonotus*) from the Duck and Buffalo rivers, Tennessee. Proc. Biol. Soc. Washington 91: 463-471.

WILLIAMS, J. D. and D. A. ETNIER. 1982. Description of a new species, *Fundulus julisia*, with a redescription of *Fundulus albolineatus* and a diagnosis of the subgenus *Xenisma* (Teleostei: Cyprinodontidae). Occ. Pap. Mus. Nat. Hist. Univ. Kansas 102: 1-20.

WILLIAMS, J. D. and C. R. ROBINS. 1970. Variation in populations of the fish *Cottus carolinae* in the Alabama River system with description of a new subspecies from below the Fall Line. Amer. Midl. Nat. 83: 368-381.

WILLIAMS, J. E. 1978. Taxonomic status of *Rhinichthys osculus* (Cyprinidae) in the Moapa River, Nevada. Southwest. Nat. 23: 511-518.

WILLIAMS, J. E. and C. E. BOND. 1980. *Gila boraxobius*, a new species of cyprinid fish from southeastern Oregon with a comparison to *G. alvordensis* Hubbs and Miller. Proc. Biol. Soc. Washington 93: 291-298.

WILLIAMS, J. E. and C. E. BOND. 1981. A new subspecies of tui chub (Osteichthyes: Cyprinidae) from Guano Basin, Nevada and Oregon. Southwest. Nat. 26: 223-230.

WILLIAMS, J. T. and R. L. SHIPP. 1982. A new species of the genus *Echiodon* (Pisces: Carapidae) from the eastern Gulf of Mexico. Copeia 1982: 845-851.

YERGER, R. and K. RELYEA. 1968. The flat headed bullheads (Pisces: Ictaluridae) of the southeastern United States, and a new species of *Ictalurus* from the Gulf Coast. Copeia 1968: 361-384.

ZORACH, T. 1972. Systematics of the percid fishes, *Etheostoma camurum* and *E. chlorobranchium* new species, with a discussion of the subgenus *Nothonotus*. Copeia 1972: 427-447.

TYPE SPECIMENS OF VASCULAR PLANTS AT TULANE UNIVERSITY, WITH A BRIEF HISTORY OF THE TULANE HERBARIUM

ANNE S. BRADBURN and STEVEN P. DARWIN
Department of Ecology, Evolution, and Organismal Biology, Tulane University, New Orleans, LA 70118

The Tulane University Herbarium is one of the principal herbaria of the Gulf South region, and was designated a National Resource Collection by the American Society of Plant Taxonomists in 1974. The University holds specimens of fungi, algae, bryophytes, and vascular plants, all housed in Dinwiddie Hall on the main campus in New Orleans. The collections of algae are maintained primarily for teaching purposes. The bryological collections (ca. 2500 specimens) are mainly of Gulf Coast mosses and liverworts representing valuable historical collections that are heavily annotated. The mycological herbarium includes roughly 11,000 fungal specimens, most of them collected from land areas around the Gulf of Mexico and the Caribbean Sea. The vascular plant herbarium presently includes 110,000 specimens of worldwide representation, but is strongest in the flora of the southeastern United States, southern California, the Rocky Mountain region of Colorado, and northern Latin America, especially the Yucatan Peninsula of Mexico. Important special collections include the type specimens listed in this report, early plant collections from the lower Mississippi River drainage, Arizona and California ferns of J. G. Lemmon, and North American Gramineae and Cyperaceae of Asa Gray. Recent accessions include collections made by Tulane faculty and students, and exchange material regularly received from some thirty institutions worldwide. Herbarium loans support a wide variety of monographic, floristic, ecological, and ethnobotanical studies. Research in systematic and taxonomic botany is further supported by the Minna F. Koch Library of Botany, a collection of more than 1000 titles housed adjacent to the herbarium and rich in historical botany and plant illustration, as well as worldwide floras, monographs, dictionaries, and essential reference works.

HISTORICAL SKETCH

The University Herbarium was established after the close of the New Orleans World's Industrial and Cotton Centennial Exposition of 1884-1885. Initially, all plant collections were part of the University Museum, which also had custody of a small herbarium belonging to the New Orleans Academy of Sciences founded in 1853. The Academy's herbarium includes some of the oldest existing Louisiana plant collections, these mostly gathered by early faculty of the Medical College of Louisiana (now Tulane University) in the 1840's. The most significant collectors who contributed to the Academy's and later the University's herbarium are given below.

Josiah Hale, M.D. (1791-1856) was a Virginia native who settled near Alexandria, Louisiana, in 1825, after taking a medical degree at Transylvania College, there receiving botanical training from Rafinesque. He retired from medical practice in 1834, devoting full energy to botany. Torrey and Gray, in their Flora of North America (1838), frequently cite specimens obtained from Hale. Among

his other correspondents were Riddell, Engelmann, Darlington, Leavenworth, Eaton, and Durand. Hale served as first President of the New Orleans Academy of Sciences, and the Hale specimens at Tulane, about one hundred, are from the Academy's herbarium (J. Ewan, J. Soc. Bibliogr. Nat. Hist. 8: 235-243. 1977).

John Leonard Riddell, M.D. (1807-1865), physician, scientist, and intellectual, arrived in New Orleans in 1836 as Professor of Chemistry at the Medical College of Louisiana. He subsequently held various professorships, including Pharmacy and Materia Medica. In 1839 he was appointed Melter and Refiner at the United States Branch Mint in New Orleans, and in 1860 Federal Postmaster, a position he held throughout the Civil War period. Riddell's interests extended to botany, mathematics, and invention, including an early typewriting machine, and the first practical binocular dissecting microscope. He was a charter member of the American Association for the Advancement of Science, and the New Orleans Academy of Sciences (K. Riess, Tulane Stud. Geol. Paleontol. 13: 1-110. 1977).

Riddell began accumulating a herbarium in 1830 while at Marietta, Ohio, and contributed his first botanical paper in 1832. He had taken the bachelor's degree in 1829 at Rensselaer School with Amos Eaton, and yet favored the taxonomic system of Jussieu over that of Linnaeus. He experimented with new methods of plant collecting, drying, and preservation; he exchanged specimens with Rafinesque and offered herbaria for sale. Riddell corresponded with the leading North American botanists, including Torrey, Engelmann, and Short. His paper "A synopsis of the flora of the western states" appeared in 1835, followed by "A supplementary catalogue of Ohio plants" in 1836. The "Catalogus florae ludovicianae," abridged from a larger manuscript, appeared in 1852.

Riddell's specimens are widely distributed among North American and European herbaria; his personal herbarium, much damaged and depleted, was acquired by Charles Mohr, and is now in the U. S. National Herbarium, Smithsonian Institution. The Riddell specimens held at Tulane, mostly from Ohio and Louisiana, and numbering about 125, were part of the New Orleans Academy of Sciences herbarium, and frequently bear specimen labels in Riddell's hand.

William Marbury Carpenter, M.D. (1811-1848) was born in West Feliciana Parish, Louisiana. He attended West Point and served as Professor of Natural Sciences at Centenary College before joining the faculty of the Medical College of Louisiana in New Orleans as Professor of Materia Medica. In 1846, Carpenter and Charles Lyell made geological excursions in Louisiana, especially studying the Mississippi River delta. Carpenter's herbarium, except for specimens sent to Torrey and others, passed to Riddell, who donated a few dozen to the New Orleans Academy of Sciences (R. S. Cocks, Tulane Graduates' Mag. 3: 122-127. 1914).

Joseph Finley Joor, M.D. (1848-1892) was a native of Louisiana. He practiced medicine in New Orleans and Thibodaux, and then in Harrisburg and Birdston, Texas, before becoming Assistant Commissioner for Texas to prepare a botanical exhibit for the 1884-85 Cotton Centennial Exposition at New Orleans. In 1888 he assumed charge of Tulane University's Museum, first as Assistant Curator, and then Curator and Professor of Botany. A few hundred Joor specimens were incorporated into the New Orleans Academy of Sciences herbarium, of which he was also curator. His personal herbarium, which was not large, passed to the Missouri Botanical Garden in 1897. Tulane's Joor specimens, largely unduplicated at Missouri, are particularly rich in southern grasses, many specimens annotated by George Vasey (J. B. S. Norton, Bot. Gaz. 26: 271-274. 1898).

Reginald W. S. Cocks, M.A. (1863-1926) was a native of Worcestershire, England. He took the master's degree at Trinity College, Cambridge, with first honors in classics. He was for a year Professor of Botany at Louisiana State University before moving in 1908 to assume the newly created Ida A. Richardson Chair of Botany at Tulane University. At about that time, Cocks began a correspondence with Charles Sprague Sargent, first Director of the Arnold Arboretum of Harvard University. In Cocks, Sargent found an able botanist and field companion on whom he could rely for data concerning the woody flora of the Gulf States. From Cocks's specimens, Sargent eventually recognized five new species or varieties of *Carya*, as well as new species of *Quercus, Crataegus*, and *Tilia*.

Cocks may have started plant collecting as early as 1892, but in 1898 he initiated the first of many annual explorations that would, over a period of twenty-five years, take him to every part of Louisiana. The result was a sizeable herbarium and series of published inventories. For a few species, Cocks specimens are still the only Louisiana record. Many of his specimens carry identifications communicated by Sargent in a regular correspondence amounting to 302 letters now preserved in the University's archive (J. Ewan, J. Arnold Arbor. 46: 1-44, 122-159, 324-361, 411-439. 1965).

Cocks was replaced on the Tulane faculty by William T. Penfound, Ph.D. (1897-1984). Although primarily a plant ecologist, Penfound and his graduate students gathered a number of Louisiana plant specimens, especially from local wetland habitats where ecological studies were being conducted. Those specimens now represent wetland vegetation existing before urban expansion in southern Louisiana, and voucher the numerous ecological studies published by Penfound and his co-workers.

When Joseph Ewan, A.B. (1909-) came to Tulane in 1947, he brought with him a personal herbarium of some 32,000 specimens, probably three or four times as many specimens as were already present in the University's collection. The Ewan herbarium is largely responsible for the wide geographical coverage of the University's present collection, as well as many of its type specimens. In addition to his own collections, mostly from southern California, the Rocky Mountain region, and South America, Ewan's herbarium also included specimens gathered by L. M. Booth (southern California), I. Clokey (Nevada), D. Keck (*Penstemon*), J. G. Lemmon (California and Arizona ferns), F. W. Pierson (California), Y. Mexia (Latin America), and the Gray Herbarium exsiccatae of the Fernald period. Specimens of *Delphinium* and *Vismia*, Ewan's own taxonomic specialties, are also well represented. The Tulane herbarium benefitted from Ewan's interest in botanical history and bibliography; a number of specimens were acquired that had been collected by well-known exploring expeditions of the nineteenth century, these mostly duplicates from European herbaria, particularly the British Museum (Natural History) and the Conservatoire et Jardin Botaniques, Geneva. A nearly complete set of Asa Gray's North American Gramineae and Cyperaceae was also added. All collections were accommodated in modern steel cases, and curated by Nesta Dunn Ewan, who worked as a volunteer for thirty years.

Since 1977, the present curators have attempted to enlarge the holdings of Louisiana plants, and acquire material from Mexico, particularly the Yucatan Peninsula, where studies are being carried out by Tulane faculty and students. To that end, a number of new exchange agreements were established with Latin American botanical institutions. Increased emphasis has also been placed upon

cultivated plants in New Orleans. Present staff includes Steven P. Darwin, Ph.D., Curator and Director (taxonomy and phylogeny of angiosperms, tropical Rubiaceae, flora of Louisiana); Anne S. Bradburn, M.S., Assistant Curator (barrier island vegetation of the Gulf Coast, flora of Yucatan, ethnobotany); Arthur L. Welden, Ph.D., Curator of Fungi (neotropical fungi, especially Thelephoraceae); and Joseph A. Ewan, A.B., Sc.D., Curator Emeritus (bibliography of American natural history).

Type Collections

The following list documents 148 vascular plant specimens in the Tulane University Herbarium (NO) known to be holotypes, isotypes, lectotypes, or isolectotypes of validly published names of species or infraspecific taxa. The list is alphabetical by family and then species, beginning with pteridophytes. For each name typified by a Tulane specimen, we provide reference to the original place of publication, locality information as it appears on the specimen label, and the location of other type specimens (e.g., holotype or other isotypes), if that information is given by the publishing author. We also cite current taxonomic placement of species names when known.

PTERIDOPHYTA

ASPLENIACEAE

Asplenium curtissii Underwood, Bull. Torrey Bot. Club 33: 194. 1906.

Curtiss 3728. United States of America. Florida: Citrus County at head of Lake Tsala Apopka. April. Holotype: NY; isotype: NO.

BLECHNACEAE

Blechnum mexiae Copeland, Univ. Calif. Publ. Bot. 17: 32, *pl. 7*. 1932.

Ynes Mexia 4237. Brazil. Minas Geraes: Districto Carangola, about 12 km along trail from Areponga to Fazenda de Grama, elevation 970 meters. January 27, 1930. Holotype: UC 419577; isotype: NO.

= *Struthiopteris mexiae* (Copeland) Ching, Sunyatsenia 5: 243. 1940.

CYATHEACEAE

Cyathea albidopaleata Copeland, Univ. Calif. Publ. Bot. 17: 25, *pl. 2*. 1932.

Ynes Mexia 4868. Brazil. Minas Geraes: Viçosa, Agricultural College, Corrida Reberro, elevation 675 meters. July 18, 1930. Holotype: UC 466100; isotype: NO.

Cyathea anacampta Alston, J. Wash. Acad. Sci. 48: 230. 1958.

Ewan 16801. Colombia. Putumayo: Cordillera Orientál, east slope, Río Ticuanayoy at confluence of Río Caquetá, elevation 1100 meters. January 20, 1945. Holotype: BM; isotype: NO.

Cyathea catacampta Alston, J. Wash. Acad. Sci. 48: 231. 1958.

Ewan 16153. Colombia. Nariño: Between Río Miraflores and Río San Martín, Volcán de Cumbal region, elevation 2680 meters. September 12-13, 1944. Holotype: BM; isotype: NO.

Cyathea ewanii Alston, J. Wash. Acad. Sci. 48: 231. 1958.

Ewan 16729. Colombia. Putumayo: Cordillera Orientál, east slope, between Mocoa and Urcusique, en route to Umbria, elevation 900 meters. January 9, 1945. Holotype: BM; isotypes: NO, US.

Cyathea leucolepismata Alston, J. Wash. Acad. Sci. 48: 231. 1958.

Ewan 16784. Colombia. Putumayo: Cordillera Orientál, east slope, near San Diego de Colorado, and tributary of Río Putumayo, between Umbria and Puerto Asis. January 16, 1945. Holotype: BM; isotypes: NO, US.

Cyathea mexiae Copeland, Univ. Calif. Publ. Bot. 17: 30, *pl. 4*. 1932.

Ynes Mexia 4882. Brazil. Minas Geraes: Viçosa, Agricultural College, hill southeast of main buildings, elevation 700 meters. July 21, 1930. Holotype: US 466093; isotype: NO.

DRYOPTERIDACEAE

Dryopteris arguta (Kaulf.) Watt. forma ***bella*** Ewan, Amer. Fern J. 34: 112. 1944.

Fosberg 8127. United States of America. California: Los Angeles County, Santa Catalina Island, Big Wash Canyon, Avalon. May 6, 1932. Holotype: COLO; isotype: NO.

Dryopteris arguta forma ***flocculosa*** Ewan, Amer. Fern J. 34: 112. 1944.

Grant, Ballou & Ewan 7908. United States of America. California: Santa Barbara County, San Miguelito Creek, 3 miles above Lompoc. May 30, 1933. Holotype: COLO; isotype: NO.

Dryopteris arguta forma ***nudata*** Ewan, Amer. Fern J. 34: 111. 1944.

Campbell 755. United States of America. California: Mariposa, Merced River below Yosemite, elevation 3800 feet. June 14, 1929. Holotype: COLO; isotype: NO.

Dryopteris normalis C. Christensen var. ***lindheimeri*** A. Br. ex C. Christensen, Kongel. Danske Vidensk.-Selsk. Skr. VII. 10(2): 182. 1912.

F. Lindheimer 742. United States of America. Texas. 1847. Holotype: B; isotypes: NO, W.

= *Dryopteris normalis* C. Christensen; D. S. Correll in C. Lundell (ed.), Flora of Texas 1: 106. 1942.

Polystichum munitum subsp. ***curtum*** Ewan, Amer. Fern J. 33: 99. 1942.

Ewan 5159. United States of America. California: San Bernardino, Sawpit Canyon, San Bernardino Mountains, elevation 4200 feet. September 7, 1931. Holotype: NO; isotypes: DS, US.

Woodsia obtusa Torr. var. ***nana*** Lemmon, Fern Bull. 15: 126. 1908.

Lemmon s.n. United States of America. Arizona: Deer Park on summit of Santa Catalina Mountains. (?)1880. Isotype: NO.

=*Woodsia pusilla* Fourn. var. *glandulosa* (Eaton & Faxon) T. Taylor, Amer. Fern J. 37: 86. 1947.

ISOETACEAE

Isoetes hieroglyphica A. A. Eaton, Fernwort Papers 10. 1900.

Pringle s.n. United States of America. Maine: St. Francis Lakes. July 31, 1880. Holotype: Herbarium of A. A. Eaton; isotype: NO.

≡*Isoetes macrospora* Durieu forma *hieroglyphica* (A. A. Eaton) Pfeiffer, Ann. Missouri Bot. Gard. 9: 194, *pl. 19*. 1922.

POLYPODIACEAE

Microgramma acatallela Alston, J. Wash. Acad. Sci. 48: 232. 1958.

Ewan 16706. Colombia. Putumayo: Cordillera Oriental (east slope), Río Mocoa drainage, 3 km above Mocoa, along trail to San Antonio, elevation 600 meters. January 8, 1945. Holotype: BM; isotypes: NO, US.

PTERIDACEAE

Eriosorus ewanii A. F. Tryon, Contr. Gray Herb. 200: 165. 1970.

Ewan 16316. Colombia. Nariño: north slope of Volcán de El Galeras above Pasto, elevation 3500 meters. October 18, 1944. Holotype: GH; isotypes: NO, S, US.

Notholaena californica Eaton subsp. ***nigrescens*** Ewan, Amer. Fern J. 32: 93, *tab. 10, fig. b*. 1942.

Wheeler 878. United States of America. California: Los Angeles County, San Gabriel Mountains, 6 miles from mouth of San Gabriel Canyon, elevation 1000 feet. June 26, 1932. Holotype: COLO; isotypes: NO, LAM.

≡*Aleuritopteris cretacea* subsp. *nigrescens* (Ewan) Munz, Aliso 4: 87. 1958.

Pomatophytum pocillatum M. E. Jones, Contr. W. Bot. 16: 12. 1930.

Jones 24690. United States of America. Arizona: Ramsey Canyon, Huachuca Mountains. September 28, 1929. Isotype: NO.

=*Cheilanthes lendigera* (Cav.) Sw.; R. & A. Tryon, Ferns Allied Pl. 249. 1982.

SCHIZAEACEAE

Anemia tripinnata Copeland, Univ. Calif. Publ. Bot. 17: 24, *pl. 1*. 1932.

Ynes Mexia 5627. Brazil. Minas Geraes: Corinto, near Fazenda do Diamante, base of Serra de Anjico, elevation 600 meters. April 15, 1931. Holotype: UC 466099; isotype: NO.

SPERMATOPHYTA

ACANTHACEAE

Dicliptera ewanii Leonard, Contr. U. S. Natl. Herb. 31: 356, *fig. 131.* 1958.

Ewan 15628. Colombia. Cundinamarca: Cordillera Orientál, 7 km east of Hilo, valley of Quebrada Chiniata, elevation 2430 meters. May 1, 1944. Holotype: NO; isotypes: K, US.

Pseuderanthemum ewanii Leonard, Contr. U. S. Natl. Herb. 31: 302, *fig. 111.* 1953.

Ewan 15629. Colombia. Cundinamarca: Cordillera Orientál, valley of Quebrada Chiniata, 7 km east of Hilo, elevation 2430 meters. May 1, 1944. Holotype: NO.

AGAVACEAE

Pleomele hawaiiensis O. & I. Degener, Fl. Hawaiiensis, Fam. 68. 1980 [Publ. privately].

Degener & Ordonez 12550. United States of America. Hawaii: Makawao, Maui. August 3, 1939. Isotypes: NO(2).

ANNONACEAE

Malmea macrocarpa R. E. Fries, Ark. Bot. (n.s.) 4: 23, *tab. 1.* 1957.

Asplund 17590. Ecuador. Province of Guayas: vicinity of Guayaquil, Cerro Azul forest. September 10, 1955. Holotype: S; isotype: NO.

APIACEAE (UMBELLIFERAE)

Sanicula odorata (Raf.) Pryer & Phillippe, Canad. J. Bot. 67: 703. 1989.

Darwin & Sundell 1379. United States of America. Mississippi: Wilkinson County, vicinity of Pinckneyville. April 28, 1979. Neotype: NO.

ARACEAE

Peltandra tharpii Barkley, Madroño 7(5): 131, *tab. 21.* 1944.

Barkley 13424. United States of America. Texas: Robertson County, near Newbaden. August 8, 1943. Holotype: TEX; isotype: NO.

ARALIACEAE

Schefflera sachamatensis Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 8: 315. 1951.

Ewan 16678. Colombia. Putumayo: Cordillera Orientál (east slope), along trail from San Francisco to Sachamate, upper Río Mocoa, 3 km above Sachamate, elevation 1700 meters. January 6, 1945. Holotype: NO.

ASTERACEAE (COMPOSITAE)

Antennaria plantaginifolia (L.) Richards var. ***monocephala*** Torrey & A. Gray, Fl. North Amer. 2: 431. 1843.

Carpenter s.n. United States of America. Louisiana: Felicianas. Syntype: NO.

≡*Antennaria solitaria* Rydberg, Bull. Torrey Bot. Club 24: 304. 1897.

Antennaria soliceps Blake, Proc. Biol. Soc. Wash. 51: 7. 1938.

Clokey & Bean 7459. United States of America. Nevada: Clark County, Charleston Mountains, elevation 3350 meters. July 18, 1937. Holotype: US 1699460; isotype: NO.

Baccharis pedersenii Cabrera, Darwiniana 16(1-2): 410. 1970.

Pedersen 2642. Argentina. Mburucuyá: Province Corrientes at Estancia "Santa Teresa." March 18, 1954. Isotype: NO.

Bidens heterodoxa (Fernald) Fernald & St. John var. ***interstes*** Fassett, Rhodora 26: 178. 1924.

Fassett 852. United States of America. Maine: Kennebec County, Kennebec River, Gardiner. September 18, 1923. Holotype: GH; isotype: NO.

≡*Bidens eatonii* Fernald var. *interstes* (Fassett) Fassett, Rhodora 27: 142. 1925.

Crepis nana Richards subsp. ***ramosa*** Babcock, Univ. Calif. Publ. Bot. 22: 542, *fig. 155.* 1947.

Thompson 7883. United States of America. Washington: Jefferson County, above Lake Constance, elevation 6000 feet. August 11, 1931. Holotype: UC 470750; isotypes: NO, DS, MO, Blake herbarium.

Eupatorium cyrilli-nelsonii A. Molina, Ceiba 22: 39. 1978.

Cirilo Nelson 3912. Honduras. Comayagua: Villa de Taulabé; quebrada La Caliche, elevation 600 meters. February 19, 1977. Holotype: TEFH; isotypes: NO, US 2851248.

≡*Peteravenia cyrilli-nelsonii* (A. Molina) King & Robinson, Phytologia 44: 86. 1979.

Grindelia camporum Greene var. ***interioris*** (Jepson) Steyermark forma ***foliacea*** Steyermark, Ann. Missouri Bot. Gard. 21: 538. 1934.

Howell 5201. United States of America. California: Solano County, 1 mile from Vacaville on road to Elmira. May 30, 1930. Holotype: CAS 179831; isotypes: NO, GH, POM.

Mikania antioquiensis Hieron var. ***subcuneata*** Robinson, Contr. Gray Herb. 104: 32. 1934.

Ynes Mexia 6492. Peru. Loreto: Iquitos, trail to San Juan, elevation 105 meters. February 7, 1932. Holotype: GH; isotype: NO.

=*Mikania banisteriae* DC.; W. Holmes [herbarium annotation, 1976].

Mikania rimachii Holmes & McDaniel, Phytologia 41: 195. 1978.

McDaniel et al. 21646. Peru. Loreto: Maynas, 3 km up Río Amazonas across from Indiana. May 26, 1978. Holotype: IBE; isotypes: NO, AMAZ, F, MO, NATC, NY, USM.

Mutisia ochroleuca Cuatrecasas, Feddes Repert. Spec. Nov. Regni Veg. 55: 122. 1953.

Ewan 16089. Colombia. Nariño: Volcán de Chiles, northwest shoulder, elevation 3100 meters. September 6-8, 1944. Holotype: F; isotype: NO.

Pyrrhopappus georgianus Shinners, Field and Lab. 21: 93. 1953.

Cronquist 4276. United States of America. Georgia: Glynn County, St. Simon's Island, near Brunswick. April 11, 1947. Holotype: SMU; isotypes: NO, GA, MO.

≡*Pyrrhopappus carolinianus* var. *georgianus* (Shinners) Ahles, J. Elisha Mitchell Sci. Soc. 80: 173. 1964.

Senecio andersonii Clokey, Bull. S. Calif. Acad. Sci. 37: 10. 1938.

Clokey & Anderson 5638. United States of America. Nevada: Clark County, Charleston Mountains, Lee Canyon, elevation 2550 meters. August 5, 1935. Holotype: Clokey herbarium; isotype: NO.

Senecio chingualensis Cuatrecasas, Feddes Repert. Spec. Nov. Regni Veg. 55: 137. 1953.

Ewan 16212. Colombia. Nariño: Cordillera Oriental, Río Chingual at San José, below La Victoria, elevation 2650 meters. September 25, 1944. Holotype: F; isotype: NO.

Vernonia angustifolia Torrey & A. Gray var. ***texana*** A. Gray, Syn. Fl. N. Amer. 1 (2): 91. 1884.

J. Hale s.n. United States of America. [Louisiana: vicinity of Alexandria (?), without date]. Lectotype: NY; possible isolectotype: NO.

≡*Vernonia texana* (A. Gray) Small, Fl. Southeastern U. S. 1160. 1903.

Zexmenia hispida A. Gray var. ***ramosissima*** Greenman, Field Mus. Nat. Hist., Bot. Ser. 3: 127, *pl. 1*. 1904.

Gaumer & sons 826. Mexico. Yucatan. Holotype: F; isotype: NO.

≡*Wedelia acapulcensis* var. *ramosissima* (Greenman) Strother, Syst. Bot. Monogr. 33: 55. 1991.

BRASSICACEAE (CRUCIFERAE)

Cardamine constancei Detling, Madroño 3(4): 176, *pl. 9*. 1935.

Constance et al. 1108. United States of America. Idaho: Idaho County, 4 miles below Lowell, on Three Devils Creek at Middle Fork of Clearwater River, Selway National Forest. June 2, 1935. Holotype: DS 229378; isotype: NO.

Lesquerella lyrata Rollins, Rhodora 57: 252, *tab. 1209*. 1955.

Rollins et al. 5599. United States of America. Alabama: Franklin County, near Richardson's Crossing, 7 miles east of Russellville. April 16, 1955. Holotype: GH; isotype: NO.

Lesquerella perforata Rollins, Rhodora 54: 190. 1952.

Rollins & Rollins 5207. United States of America. Tennessee: Wilson County, five miles north of Lebanon. March 30, 1952. Holotype: GH; isotype: NO.

CAMPANULACEAE

Centropogon minimus McVaugh, Brittonia 6: 467. 1954.

Ewan 15699. Colombia. Antioquia: Páramo de Sonsón, above Sonsón, Cordillera Centrál, elevation 2743 meters. May 23, 1944. Holotype: NA; isotype: NO.

Siphocampylus bullatas McVaugh, Brittonia 6: 457. 1949.

Ewan 16611. Colombia. Nariño: West side of Volcán Doña Juana, elevation 3200-3400 meters. December 16, 1944. Holotype: US; isotype: NO.

CARYOPHYLLACEAE

Silene andersonii Clokey, Bull. S. Calif. Acad. Sci. 38: 2. 1939.

Clokey 7514. United States of America. Nevada: Clark County, Charleston Mountains, Lovell Canyon, elevation 2600 meters. August 9, 1937. Holotype: Clokey herbarium; isotypes: NO, CAS.

≡*Silene verecunda* Wats. subsp. *andersonii* (Clokey) Hitchcock & Maguire, Univ. Wash. Publ. Biol. 13: 43. 1947.

CLUSIACEAE (GUTTIFERAE)

Clusia chusqueae Ewan, Nat. Hist. Misc. 88: 6. 1951.

Ewan 15741. Colombia. Antioquia: Cordillera Centrál, Alto Capiro, above Sonsón-Abejorral camino, elevation 2800 meters. May 26-28, 1944. Holotype: NA; isotypes: NO, COL.

Vismia buchtienii Ewan, Contr. U. S. Natl. Herb. 35(5): 353. 1962.

Buchtien 2022. Bolivia. San Antonio, Mapui region, elevation 850 meters. December, 1907. Holotype: US 1159313; isotypes: NO, L.

Vismia cuatrecasasii Ewan, Contr. U. S. Natl. Herb. 35(5): 331. 1962.

Cuatrecasas 16687. Colombia. Dept. del Valle: Río Calima (región del Chocó); entre La Herradura de Ordóñez y Peña de Campotriste, elevation 5-10 meters. March 3, 1944. Holotype: US 1950013; isotype: NO.

Vismia guianensis subsp. ***persicoides*** Ewan, Contr. U. S. Natl. Herb. 35(5): 342. 1962.

Schultes & Cabrera 12570. Colombia. Amazonas-Vaupés: Soratama, Río Apaporis, entre el Río Pacoa y el Río Kananarí, elevation 250 meters. June 15, 1951. Holotype: NO; isotype: US.

Vismia laxiflora Reichardt in Martius, Fl. Bras. 12(1): 203. 1878.

Schomburgk 837. British Guiana [or Venezuela? - vide Ewan, Contr. U. S. Natl. Herb. 35: 361. 1962]. Isotype: NO.

Vismia rufa Cuatrecasas, Revista Acad. Colomb. Ci. Exact. 7: 47, *fig. 1*. 1946.

Cuatrecasas 17449. Colombia. Dept. del Valle: Costa del Pacifico; Río Cajambre, elevation 5-80 meters. May 5-15, 1944. Holotype: Colecion de la Comision de Botanica del Valle; isotype: NO.

Vismia urceolata Ewan, Contr. U. S. Natl. Herb. 35(5): 324. 1962.

E. L. Little & R. R. Little 8275. Colombia. Puerto López: Intendencia del Meta, elevation 240 meters. July 28, 1944. Holotype: US 2166544; isotype: NO.

CYCLANTHACEAE

Sphaeradenia stylosa Harling, Acta Horti Berg. 18(1): 352, *fig. 94g-h, tab. 85*. 1958.

Ewan 16085. Colombia. Nariño: Volcán de Chiles, northwest slope, Mayasquer trail, elevation 2560-3350 meters. September 6-8, 1944. Holotype: US; isotype: NO.

CYRILLACEAE

Purdiaea stenopetala Grisebach, Abh. Königl. Ges. Wiss. Göttingen 9: 45. 1860.

C. Wright 341. Cuba. Orientali. 1859-1860. Isotypes: NO, MO, GH, NY, UC.

ERICACEAE

Arctostaphylos pinetorum Rollins, Rhodora 39: 462. 1937.

Rollins 1586. United States of America. Colorado: Mesa County, Uncompahgre Plateau, T 50 N, R 16 W, 3 miles west of Cold Spring Ranger Station, elevation 7500 feet. September 1, 1936. Holotype: GH; isotype: NO.

≡*A. parryana* var. *pinetorum* (Rollins) Wieslander & Schreiber, Madroño 5: 46. 1939.

EUPHORBIACEAE

Ditaxis diversiflora Clokey, Bull. S. Calif. Acad. Sci. 37: 6. 1938.

Clokey 7576. United States of America. Nevada: Clark County, Charleston Mountains, Charleston Park, elevation 2280 meters. May 24, 1937. Holotype: Clokey herbarium; isotype: NO.

Euphorbia gracilior Cronquist, Castanea 14: 102. 1949.

Cronquist 5334. United States of America. Georgia: Tattnall County, 2 mi. northwest of Reidsville. June 16, 1948. Holotype: US; isotypes: NO, GA, GH, MICH, MO, NY, PH, SMU, UC.

=*Euphorbia exserta* (Small) Coker; M. J. Huft [herbarium annotation, 1979].

FABACEAE (LEGUMINOSAE)

Cynometra insularis A. C. Smith, Sargentia 1: 38. 1942.

Degener 15491. Fiji. Viti Levu: Ra Province, Vatundamusewa, near Rewasa. June 6, 1941. Holotype: A; isotype: NO.

Erythrina elenae Howard & Briggs, J. Arnold Arbor. 34: 183. 1953.

Howard, Briggs, et al. 377. Cuba. Las Villas: Hillside slope 0.25 mile west of spot where Camino de la Sur crosses Rio San Juan along north slope of Trinidad Mountains. July 1-20, 1950. Holotype: GH; isotype: NO.

Galactia bahamensis Urban, Symb. Antill. 2: 331. 1900.

Hitchcock s.n. Bahamas. Crooked Island. November, 1890. Holotype: MO 21394; isotype: NO.

Rhynchosia rojasii Hassler, Feddes Repert. Spec. Nov. Regni Veg. 7: 77. 1909.

Hassler 14024. Paraguay. Sierra de Amambay [without date]. Isotype: NO.

Trifolium grantianum Heller, Muhlenbergia 1: 136. 1906.

G. B. Grant 6343. United States of America. California: Mt. San Gorgonio, San Bernardino Mountains. July 23, 1904. Holotype: POM; isotypes: NO, UC 127247.

≡*Trifolium monanthum* A. Gray var. *grantianum* (Heller) Parish, Plant World 20: 220. 1917; Zohary & D. Heller, Genus Trifolium, 544. 1984.

FAGACEAE

Quercus* × *ganderi C. B. Wolf, Proc. Calif. Acad. Sci., Ser. 4, 25: 178. 1944.

Wolf & Everett 9543. United States of America. California: San Diego County, between Lake Henshaw and Santa Ysabel, just 300 yds. above entrance to Volcan Indian School, elevation 3100 feet. October 20, 1939. Isotype: NO.

Quercus grandidentata Ewan, Bull. Torrey Bot. Club 64: 512. 1927.

Ewan 8487. United States of America. California: Los Angeles County, San Gabriel Mountains, Monrovia, 2 mi. above A. T. and S. F. railroad tracks at mouth of Sawpit Canyon (Monrovia Canyon). December 27, 1934. Holotype: UC 533189; isotype: NO.

Quercus stellata Wangenh. var. ***araniosa*** Sargent, Bot. Gaz. 65: 441. 1918.

Palmer 8770. United States of America. Louisiana: Natchitoches Parish, Grand Ecore. October 2, 1915. Holotype: A; isotype: NO.

= *Quercus stellata* Wangenh. var. *margaretta* (Ashe) Sargent; Little, Checklist U. S. Trees (U. S. Forest Serv. Agric. Handb. vol. 541), 242. 1979.

GENTIANACEAE

Lisianthius peduncularis L. O. Williams, Fieldiana, Bot. 31: 408, *fig. 1.* 1968.

Allen 3410. Panama. Coclé: El Valle de Antón, elevation 1000 meters. March 16, 1946. Holotype: MO; isotype: NO.

[The generic name was spelled "*Lisianthus*" in the species protologue; this was corrected in Ann. Missouri Bot. Gard. 62(1): 71. 1975.]

HYDROPHYLLACEAE

Nemophila menziesii Hook. & Arn. subsp. ***australis*** A. Brand var. ***minima*** A. Brand, Pflanzenreich IV. Fam. 251 (Heft 59): 50. 1913.

M. E. Jones 3037. United States of America. California: Los Angeles County, Pasadena. February 25, 1882. Holotype: B; isotype: NO.

JUNCACEAE

Juncus duranii Ewan, Rhodora 47: 186. 1945.

J. & N. Ewan 10060. United States of America. California: Los Angeles County, San Gabriel Mountains, Lilly Springs, north slope of Mt. Hawkins. August 14, 1936. Holotype: COLO; isotype: NO.

LAMIACEAE (LABIATAE)

Monardella lanceolata A. Gray var. ***glandulifera*** I. M. Johnston, Bull. S. Calif. Acad. Sci. 18: 20. 1919.

Johnston 2139. United States of America. California: San Antonio Mountains, Brown's Flats, Upper Sonoran Zone, elevation 4300 feet. September 1, 1918. Holotype: POM; isotypes: NO, DS, UC.

Salvia carnosa Dougl. subsp. ***gilmanii*** Epling, Ann. Missouri Bot. Gard. 25: 132. 1938.

Epling & Gilman s.n. United States of America. California: Inyo County, Panamint Mountains above Piñon Mesa, Wild Rose Canyon. July 7, 1937. Holotype: LA; isotypes: NO, CAS, LA, MO, UC.

= *Salvia dorrii* (Kellogg) Abrams var. *dorrii*; J. L. Strachan, Brittonia 34: 160. 1982.

LAURACEAE

Cryptocarya degeneri Allen, Sargentia 1: 34. 1942.

Degener 15412. Fiji. Viti Levu: Ra, Mataimeravula, vicinity of Rewasa, near Vaileka, elevation 50-200 meters. June 3, 1941. Holotype: A; isotypes: NO, BISH, K, NY, US.

= *Cryptocarya hornei* Gillespie; A. C. Smith, Fl. Vit. Nov. 2: 129. 1981.

LILIACEAE

Allium eurotophilum Wiggins, Contr. Dudley Herb. 1: 164, *pl. 12, fig. 1.* 1933.

Wiggins & Demaree 5040. Mexico. Baja California: Sierra San Pedro Mártir, elevation 2800 meters. September 24, 1930. Holotype: DS 194171; isotype: NO.

Calochortus rhodothecus Clokey, Bull. S. Calif. Acad. Sci. 37: 1. 1938.

Clokey 7479. United States of America. Nevada: Clark County, Charleston Mountains, Charleston Park, elevation 2270 meters. July 21 [July 12 in protologue], 1937. Holotype: Clokey herbarium; isotype: NO.

MAGNOLIACEAE

Magnolia acuminata (L.) L. var. ***ludoviciana*** Sargent, Bull. Torrey Bot. Club 55: 464. 1928.

R. S Cocks s.n. United States of America. Louisiana: West Feliciana, Catalpa. October 15, 1915. Lectotype: NO.

Magnolia ashei Weatherby, Rhodora 28: 35. 1926.

W. W. Ashe 3. United States of America. Florida: Okaloosa County, Rogue Creek. April 26, 1925; June 6, 1925. Holotype: NCU?; isotypes: NO, GH.

MALVACEAE

Sida ampla M. E. Jones, Contr. W. Bot. 15: 146. 1929.

Jones 22858. Mexico. Nayarit: Acaponeta. February 25, 1927. Holotype: POM; isotypes: NO, CAS, F, NY(2), WIS(2).

= *Sida aggregata* Presl; Fryxell, Syst. Bot. Monogr. 25: 382. 1988.

Sida wendtii Fryxell, Phytologia 46(6): 393. 1980.

Koch, Fryxell, & Wendt 79424. Mexico. Oaxaca: Santo Domingo Armenta, Terracería a Santo Domingo A., 1.5 km al S. de la carretera Pinotepa Nacional-Acapulco, 29 km al O. de Pinotepa Nacional, sobre la carretera a Acapulco, elevation 20 meters. November 8, 1979. Holotype: ENCB; isotypes: NO, BM, BR, CAS, CHAPA, CTES, F, K, MARY, MICH, MO, NY, TEX, WIS, XAL.

= *Sida brachystemon* DC.; Fryxell, Syst. Bot. Monogr. 25: 385. 1988.

MARCGRAVIACEAE

Marcgravia fosbergiana Ewan, Nat. Hist. Misc. 88: 2. 1951.

Ewan 16053. Colombia. Nariño: Río San Juan at pueblo of San Antonio, elevation 1370 meters. September 3, 1944. Holotype: NA; isotypes: NO, COL.

NYCTAGINACEAE

Mirabilis macfarlanei Constance & Rollins, Proc. Biol. Soc. Wash. 49: 148. 1936.

Constance, Rollins, Clements, & Dillon 1579. United States of America. Oregon: Wallowa County, Lower Cottonwood Landing, between mouth of Somer's Creek and Pittsburg Landing, T 27 N, R 1-2 W, Snake River Canyon. May 15, 1936. Isotypes: NO(2).

PIPERACEAE

Peperomia ewanii Trelease & Yuncker, Piperac. N. South Amer. 2: 573, *fig. 497*. 1950.

Ewan 16574. Colombia. Nariño: 6 km above San Jose, on trail to Las Mesas, via Quebrada San Francisco, elevation 2700 meters. December 14, 1944. Holotype: NA; isotypes: NO, ILL.

Peperomia glareosa Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 50. 1936.

Ynes Mexia 6236. Peru. Loreto: above Pongo de Manseriche, bank of Río Santiago, elevation 200 meters. December 6, 1931. Holotype: UC; isotypes: NO, GH.

Peperomia mansericheana Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 60. 1936.

Ynes Mexia 6196. Peru. Loreto: above Pongo de Manseriche, streamlet near mouth of Río Santiago, elevation 210 meters. December 1, 1931. Holotype: UC; isotypes: NO, GH.

≡*Peperomia vulcanicola* C. DC. var. *mansericheana* (Trelease) Trelease & Yuncker, Piperac. N. South Amer. 2: 606. 1950.

Peperomia santiagoana Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 92, 1936.

Ynes Mexia 6146. Peru. Loreto: above Pongo de Manseriche on left bank of Río Santiago, elevation 200 meters. November 23, 1931. Holotype: UC; isotypes: NO, GH.

Piper ewanii Yuncker, Piperac. N. South Amer. 1: 278. 1950.

Ewan 16752. Colombia. Putumayo: near San Diego de Colorado, vicinity of Finca Pedrogoso, between Umbria and Puerto Asis. January 11, 1945. Holotype: ILL; isotype: NO.

Piper indianonum Trelease, Field Mus. Nat. Hist., Bot. Ser 13, part II: 176. 1936.

Ynes Mexia 6396. Peru. Loreto: Distrito Iquitos, Fundo Indiana, elevation 110 meters. January 21, 1932. Holotype: UC; isotype: NO.

Piper paranapuranum Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 204. 1936.

Ynes Mexia 6075. Peru. Loreto: near Yurimaguas, Río Paraná-pura, elevation 180 meters. October 24, 1931. Holotype: UC; isotypes: NO, GH.

Piper rio-nechianum Yuncker, Piperac. N. South Amer. 1: 211, *fig. 174*. 1950.

Ewan 15827. Colombia. Antioquia: Dos Bocas, on Río Nechi, near Pato. June 23-25, 1944. Holotype: ILL; isotypes: NO, NA.

Piper scabridulicaule Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 229. 1936.

Ynes Mexia 6106 [=6100 ?]. Peru. Loreto: above Pongo de Manseriche at mouth of Río Santiago. November 14, 1931. Isotype: NO.

Piper tingens Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 244. 1936.

Ynes Mexia 6072. Peru. Loreto: near Yurimaguas, Río Paraná-pura, elevation 180 meters. October 24, 1931. Holotype: UC; isotype: NO.

Piper tortuosivenosum Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 244. 1936.

Ynes Mexia 6199. Peru. Loreto: above Pongo de Manseriche, near mouth of Río Santiago, elevation 210 meters. December 2, 1931. Holotype: UC; isotypes: NO, GH.

Piper tumidicondylii Trelease, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 247. 1936.

Ynes Mexia 6431. Peru. Loreto: Distrito Iquitos, Rancho Indiana, elevation 110 meters. January 25, 1932. Holotype: UC; isotype: NO.

POLEMONIACEAE

Eriastrum brandegeae H. L. Mason, Madroño 8(3): 88. 1945.

Mason 12604. United States of America. California: Obsidian Ridge, southeast of Borax Lake. June 28, 1945. Isotype: NO.

POLYGONACEAE

Chorizanthe procumbens Nutt. var. ***mexicana*** Goodman, Ann. Missouri Bot. Gard. 21: 87. 1934.

Fosberg 8281. Mexico. Baja California: Tecate, elevation 600 meters. May 30, 1932. Holotype: MO; isotype: NO.

Eriogonum baileyi S. Wats. var. ***porphyneticum*** S. Stokes ex M. E. Jones, Contr. W. Bot. 11: 17. 1903.

M. E. Jones s.n. United States of America. Nevada: Palisade. September 6, 1881. Isotype: NO.

= *Eriogonum baileyi* S. Wats. var. *baileyi*; James L. Reveal [herbarium annotation, 1969].

Eriogonum campanulatum Nutt. subsp. ***leptothecum*** S. Stokes, Genus Eriog. 78. 1936.

S. G. Stokes 206. United States of America. Colorado: Boulder County, five miles north of Boulder on road to Fort Collins. August 2, 1934. Holotype: CAS 215300; isotype: NO.

Eriogonum eastwoodianum J. T. Howell, Leafl. W. Bot. 2: 133. 1938.

Eastwood & Howell 5857. United States of America. California: Fresno County, in mountains south of Jacalitos Creek, 14 miles from Coalinga on road to Parkfield. June 13, 1938. Holotype: CAS 257469; isotype: NO.

Eriogonum eximum Tidestrom, Proc. Biol. Soc. Wash. 36: 181. 1923.

Heller 10649. United States of America. Nevada: Washoe County, mountains west of Franktown, elevation 5800 feet. August 16, 1912. Holotype: US 509910; isotype: NO.

≡*Eriogonum ovalifolium* Nutt. var. *eximium* (Tidestrom) J. T. Howell, Mentzelia 1: 19. 1976 ["1975"].

Eriogonum heermannii Dur. & Hilg. var. ***floccosum*** Munz, Manual S. Calif. Bot. 597. 1935.

Munz 12915. United States of America. California: Mohave Desert, eastern San Bernardino County, Clark Mountains, elevation 5200 feet. September 16, 1932. Holotype: POM 183921; isotype: NO.

Eriogonum nudicaule (Torrey) Small subsp. ***parleyense*** S. Stokes, Genus Eriog. 84. 1936.

Stokes 213. United States of America. Utah: Parley's Canyon, Wasatch [Wahsatch] Mountains, elevation 6000 feet. August 18 [or 17?], 1934. Holotype: CAS 215298; isotype: NO.

=*Eriogonum brevicaule* Nutt. var. *brevicaule*; S. Welsh et al. Utah Fl., Great Basin Nat. Mem. 9: 476. 1987.

RANUNCULACEAE

Delphinium amabile Tidestrom subsp. ***clarianum*** Ewan, Univ. Colorado Stud., Ser. D, Phys. Sci. 2: 198. 1945.

M. Clary s.n. United States of America. California: Riverside-San Bernadino County line, Lost Horse Canyon, Little San Bernardino Mountains, Conchilla Range. May 12, 1932. Holotype: COLO; isotype: NO.

Delphinium bicornutum Hemsley subsp. ***oaxacanum*** Warnock, Madroño 31: 247. 1984.

Warnock 2536. Mexico. Oaxaca: about 11.5 mi. south of Miahuatlan on Puerto Angel road (Pemex Route 175). October 19, 1981. Holotype: TEX; isotypes: NO, ENCB, ILL, MEXU, MO, SHST.

Delphinium collinum Ewan, Bull. Torrey Bot. Club. 63: 338. 1936.

Epling & Robison s.n. United States of America. California: San Diego County, ridge between Campbell's Ranch and Mason Valley. April 4, 1932. Holotype: LA; isotype: NO.

Delphinium disjunctum Ewan, Nat. Hist. Misc. 61: 1-3. 1950.

Meyer & Rogers 3019. Mexico. Nuevo Leon: Cerro del Viejo, 15 mi. west of Dulces Nombres, Municipality Zaragoza, elevation 2500 meters. August 19, 1948. Holotype: MO; isotype: NO.

Delphinium gypsophilum Ewan, Univ. Colorado Stud., Ser. D, Phys. Sci. 2: 189, *fig. 54*. 1945.

Ewan 10295. United States of America. California: West Fresno County, mouth of Pinoche Creek, on east facing slope, elevation 500 feet. April 25, 1937. Holotype: COLO; isotype: NO.

Delphinium hesperium A. Gray forma ***hirsutum*** Ewan, Univ. Colorado Stud., Ser. D, Phys. Sci. 2: 179. 1945.

Ewan 9562. United States of America. California: Sutter County, eastern side of North Butte, elevation 800 feet. May 9, 1936. Holotype: COLO; isotype: NO.

Delphinium hesperium A. Gray forma ***pallescens*** Ewan, Univ. Colorado Stud., Ser. D, Phys. Sci. 2: 179. 1945.

Ewan 8835. United States of America. California: Napa County, along Steel Canyon Road, 0.5 mile from junction with Monticello-Winters Road. April 30, 1934. Holotype: COLO; isotype: NO.

Delphinium hutchinsoniae Ewan, Bull. Torrey Bot. Club 78: 379. 1951.

S. Hutchinson 7423. United States of America. California: Monterey County, in sand on beach 2.5 miles south of Monterey, elevation 10 feet. May 28, 1938. Holotype: COLO; isotype: NO.

Delphinium menziesii DC. subsp. ***pyramidale*** Ewan, Univ. Colorado Stud., Ser. D, Phys. Sci. 2(2): 107. 1945.

H. C. Gilbert 1133. United States of America. Oregon: Benton County, northwest of Corvallis. May 6, 1916. Holotype: OSC 4151; isotypes: NO, NDA.

Delphinium ramosum Rydberg forma ***sidalceoides*** Ewan, Bull. Torrey Bot. Club 78: 380. 1951.

Weber 5798. United States of America. Colorado: Saguache County, along road to Stone Cellar Ranger Station and Saguache Park, near junction of main highway, 4 miles west of Cochetopa Pass, elevation 9700 feet. July 28, 1950. Holotype: COLO; isotype: NO.

Delphinium treleasei B. F. Bush, Minnesota Bot. Stud. 2: 444. 1900.

Bush 73. United States of America. Missouri: Eagle Rock. May 28, 1898. Isotype: NO.

Ranunculus alveolatus Carter, Amer. J. Bot. 26(7): 555, *fig. 1e-f*. 1939.

A. Carter 1244. United States of America. California: Sacramento County, between Fair Oaks and Folsom, 1.5 miles southeast of Orangevale, elevation 200 feet. April 25, 1937. Holotype: UC 604080; isotype: NO.

ROSACEAE

Horkelia caeruleomontana St. John, Fl. Southeastern Washington. 199. 1937.

St. John & Smith 8329. United States of America. Washington: Columbia County, Wildcat Springs, R 40 E, T 7 N, elevation 5500 feet. July 5, 1927. Holotype: State College of Washington; isotype: NO.

Malus coronaria (L.) Mill. var. ***puberula*** Rehder, Trees Shrubs 2: 229. 1913.

R. S. Cocks s.n. United States of America. Louisiana: Winnfield. April, 1913. Holotype: A; isotype: NO.

Potentilla beanii Clokey, Bull. S. Calif. Acad. Sci. 38: 4. 1939.

Clokey 7974. United States of America. Nevada: Clark County, Charleston Mountains, Ridge to Charleston Peak, elevation 3270 meters. July 22, 1938. Holotype: Clokey herbarium; isotypes: NO, CI.

Potentilla cryptocaulis Clokey, Bull. S. Calif. Acad. Sci. 37: 4, *pl. 1*. 1938.

Clokey 7567. United States of America. Nevada: Clark County, Charleston Mountains, Charleston Peak, elevation 3500 meters. July 18 [or 8?], 1937. Holotype: Clokey herbarium; isotypes: NO, CI, GH.

≡*Ivesia cryptocaulis* (Clokey) Keck, Lloydia 1: 130. 1938.

Rubus parviflorus Nutt. forma ***micradenius*** Fassett, Ann. Missouri Bot. Gard. 28: 324. 1941.

Fassett 20193. United States of America. Colorado: Routt County, gorge below Fish Creek Falls, Steamboat Springs. July 3, 1939. Holotype: WIS; isotype: NO.

Rubus parviflorus Nutt. var. ***velutinus*** (Hook. & Arn.) Greene forma ***paratrichophorus*** Fassett, Ann. Missouri Bot. Gard. 28: 325. 1941.

M. E. Mathias 1389. United States of America. California: Monterey County, about 12 miles south of Carmel, 0.5-1 miles from ocean, Palo Colorado Canyon, Santa Lucia Mountains. August 7, 1938. Holotype: WIS; isotype: NO.

Rubus parviflorus Nutt. var. ***velutinus*** (Hook. & Arn.) Greene forma ***parahypomalacus*** Fassett, Ann. Missouri Bot. Gard. 28: 325. 1941.

B. O. Schreiber 2538. United States of America. California: Marin County, 1.5 miles southeast of Abbot's Lagoon. August 6, 1938. Holotype: WIS; isotype: NO.

Rubus parviflorus Nutt. var. ***velutinus*** (Hook. & Arn.) Greene forma ***parbifarius*** Fassett, Ann. Missouri Bot. Gard. 28: 325. 1941.

L. Constance 2397. United States of America. California: Alameda County, Berkeley, north slope of Strawberry Creek Canyon, 0.7 mile above its mouth, elevation 1100 feet. August 4, 1938. Holotype: WIS; isotype: NO.

RUBIACEAE

Galium munzii Hilend & Howell forma ***glabrum*** Ehrendorfer, Contr. Dudley Herb. 5: 9. 1956.

Clokey 8134. United States of America. Nevada: Clark County, Charleston Mountains, canyon above Wilson's Ranch, elevation 1230 meters. June 7, 1938. Holotype: GH; isotypes: NO, ARIZ, DZ, POM, RSA.

≡*Galium matthewsii* A. Gray var. *magnifolium* Dempster, Brittonia 10: 189. 1958.

Hedyotis acuminata (Cham. & Schlechtend.) Steud. forma ***brownii*** Fosberg, Bishop Mus. Bull. 174: 79. 1943.

Degener et al. 11672. United States of America. Hawaii: Waimalu, Oahu, elevation 1000 feet. November 3, 1935. Holotype: Degener herbarium; isotype: NO.

=*Hedyotis acuminata* (Cham. & Schlechtend.) Steud.; W. L. Wagner, D. Herbst, & S. H. Sohmer, Manual Fl. Pl. Hawaii, 1138. 1990.

Hedyotis halei Torrey & A. Gray, Fl. N. Amer. 2: 42. 1841.

J. Hale s.n. United States of America. Louisiana: near Alexandria [without date]. Holotype: NY; isotype: NO.

=*Pentodon pentandrus* (Schum. & Thonn.) Vatke; Correll & Johnston, Manual Vasc. Pl. Texas, 1490. 1970.

Hedyotis thyrsoidea Fosberg, Bishop Mus. Bull. 174: 52. 1943.

Degener 11722. United States of America. Hawaii: near Laianui, Molokai. May 18, 1928. Holotype: Degener herbarium; isotype: NO.

=*Hedyotis mannii* Fosberg; W. L. Wagner, D. Herbst, & S. H. Sohmer, Manual Fl. Pl. Hawaii, 1148, 1151. 1990.

Perama mexiae Standley ex Steyermark, Mem. New York Bot. Gard. 10(5): 246, *fig. 81a-e. 1964*.

Ynes Mexia 5837. Brazil. Minas Geraes: Diamantina, Olaria, elevation 1245 meters. May 14, 1931. Holotype: NY; isotype: NO.

Rudgea mexiae Standley, Field Mus. Nat. Hist., Bot. Ser. 13, part II: 165. 1936.

Ynes Mexia 6366. Peru. Loreto: above Pongo de Manseriche, right of mouth of Río Santiago, elevation 210 meters. January 1, 1932. Holotype: F 718409; isotype: NO.

SAXIFRAGACEAE

Heuchera duranii Bacigalupi, Contr. Dudley Herb. 1: 191. 1933.

Duran 2817. United States of America. California: Mono County, McAfee Meadow, White Mountains, elevation 11,700 feet. July 26, 1930. Holotype: DS 207811; isotype: NO.

SCROPHULARIACEAE

Castilleja clokeyi Pennell, Proc. Acad. Nat. Sci. Philadelphia 89: 420. 1938.

Clokey 7322. United States of America. Nevada: Clark County, Charleston Mountains, on north slope of Kyle Canyon, elevation 2425 meters. July 8, 1936. Holotype: PH; isotype: NO.

Pedicularis semibarbata A Gray var. ***charlestonensis*** Pennell & Clokey, Bull. S. Calif. Acad. Sci. 38: 6. 1939.

Clokey 7718. United States of America. Nevada: Clark County, Charleston Mountains, Charleston Park, elevation 2300 meters. May 11, 1936 (flowers); June 21, 1937 (fruit). Holotype: Clokey herbarium; isotypes: NO, PH.

=*Pedicularis semibarbata* subsp. *charlestonensis* (Pennell & Clokey) Clokey, Madroño 8: 60. 1945.

Penstemon alluviorum Pennell in Small, Manual Southeastern Fl. 1203. 1933.

Pennell 11504. United States of America. Arkansas: Craighead County, Jonesboro. June 7, 1923. Holotype: PH; isotype: NO.

=*Penstemon digitalis* Nutt. ex Sims; E. B. Smith, Atlas Vasc. Pl. Arkansas, ed. 2, 253. 1988.

Penstemon arkansanus Pennell, Proc. Acad. Nat. Sci. Philadelphia 73: 493. 1922.

Pennell 10640. United States of America. Arkansas: Pulaski County, Pulaski Heights, Little Rock. May 31, 1920. Holotype: NY; isotype: NO.

≡*Penstemon pallidus* Small subsp. *arkansanus* (Pennell) Bennett, Phytologia 9: 57. 1963.

Penstemone bicolor (Brandegee) Clokey & Keck subsp. ***roseus*** Clokey & Keck, Bull. S. Calif. Acad. Sci. 38: 12. 1939.

Clokey 5850. United States of America. Nevada: Clark County, Nelson, El Dorado Canyon, elevation 600 meters. May 14, 1938. Holotype: Clokey herbarium; isotypes: NO, CI.

Penstemon connatifolius A. Nelson, Amer. J. Bot. 18: 437. 1931.

Nelson 10314. United States of America. Arizona: Apache Trail, not many miles from Roosevelt Dam. May 3, 1925. Holotype: RM; isotype: NO.

Penstemon keckii Clokey, Madroño 4: 128. 1937.

Clokey 7312. United States of America. Nevada: Clark County, Charleston (Spring) Mountains, elevation 2670 meters. July 3, 1936. Holotype: Clokey herbarium; isotypes: NO, and distributed in *Plantae Exsiccatae Grayanae*.

Penstemon multicaulis Pennell, Proc. Acad. Sci. Philadelphia 73: 494. 1922.

Pennell 10616. United States of America. Arkansas: Franklin County, Ozark. May 29, 1920. Holotype: NY; isotypes: NO, PH.

=*Penstemon arkansanus* Pennell; E. B. Smith, Atlas Vasc. Pl. Arkansas, ed. 2, 251. 1988.

Penstemon neotericus Keck, Univ. Calif. Publ. Bot. 16: 398, *fig. 13*. 1932.

Keck 958. United States of America. California: Plumas County, halfway between Chester and Westwood, elevation 1465 m (4800 feet). July 24, 1930. Holotype: DS 185575; isotypes: NO, CA, CI, GH, K, MISS, NY, PH, POM, UC.

SOLANACEAE

Solanum arborescens Clokey, Bull. S. Calif. Acad. Sci. 30: 60. 1931; non *Solanum arborescens* Moench.

Clokey 5049 [5047 ?]. United States of America. California: Santa Cruz Island, Pelican Bay, elevation 60 meters. May 23, 1930. Holotype: Clokey herbarium; isotype: NO.

≡*Solanum clokeyi* Munz, Bull. S. Calif. Acad. Sci. 31: 69. 1932.

≡*Solanum wallacei* (A. Gray) Parish var. *clokeyi* (Munz) McMinn, Illustr. Manual Calif. Shrubs, 491. 1939.

Solanum inopinum Ewan, Nat. Hist. Misc. 88: 8. 1951.

Ewan 16081. Colombia. Nariño: vicinity of San Juan, on Río San Juan. September 5, 1944. Holotype: NO(2).

Solanum siparunoides Ewan, Nat. Hist. Misc. 94: 1. 1952.

Ewan 15766. Colombia. Antioquia: Cordillera Centrál, Alto Capiro, above Sonson-Abejorral camino. May 26-28, 1944. Holotype: NA; isotypes: NO, COL.

TILIACEAE

Tilia floridana Small var. ***oblongifolia*** Sargent, Bot. Gaz. 66: 435. 1918.

Cocks 788. United States of America. Alabama: road to Hatcher's Bluff, near Sardis. June 5, 1915; August 14, 1915 (fruit). Holotype: A; isotype: NO.

=*Tilia caroliniana* Mill.; J. & R. Kartesz, Synonymized Checklist Vasc. Fl. U. S. 462. 1980.

Tilia nuda Sargent var. ***glaucescens*** Sargent, Bot. Gaz. 66: 427. 1918.

Cocks 786. United States of America. Alabama: Dallas County, Cocks place, Alabama River [G. . . 's Landing], Sardis. June 11, 1915; July 15, 1915 (fruit). Holotype: A; isotype: NO(2).

≡*Tilia leucocarpa* Ashe var. *glaucescens* (Sargent) Sudworth, Checklist Forest Trees U. S. 201. 1927.

VERBENACEAE

Aegiphila salticola Moldenke, Feddes Repert. Spec. Nov. Regni Veg. 37: 211. 1934.

Ynes Mexia 5922. Brazil. Pará: Districto Acará, Thomé Assú, Japanese Colony, elevation 30 meters. July 16, 1931. Holotype: F; isotype: NO.

Lantana minasensis Moldenke, Phytologia 2: 138. 1946.

Ynes Mexia 4448a. Brazil. Minas Geraes: about km 2 along road from Viçosa to Barroso, elevation 690 meters. March 9, 1930. Holotype: NY; isotype: NO.

Lantana rubella Moldenke, Phytologia 1: 464. 1940.

Ynes Mexia 5845. Brazil. Minas Geraes: Diamantina, upper slope of Serra do Rio Grande, elevation 1290 meters. May 15, 1931. Holotype: NY; isotype: NO.

Verbena hasslerana Briq. Bull. Herb. Boissier (II) 4: 1056. 1904.

Hassler 6464. Paraguay. [vicinity of Tobaty, September, 1900]. Syntypes: G-DEL, NO [vide Moldenke, Phytologia 9: 177. 1963].

VOCHYSIACEAE

Vochysia braceliniae Standley, Field Mus. Nat. Hist., Bot. Ser. 22(3): 149. 1940.

Ynes Mexia 6081. Peru. Loreto: near Yurimaguas on trail to San Ramón, elevation 180 meters. October 25, 1931. Holotype: F; isotype: NO.

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TULANE STUDIES IN ZOOLOGY AND BOTANY

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THREE NEW SPECIES OF *ETHEOSTOMA*, SUBGENUS *ULOCENTRA*, FROM THE GULF COASTAL PLAIN OF SOUTHEASTERN UNITED STATES

ROYAL D. SUTTKUS
Museum of Natural History, Tulane University, Belle Chasse, LA 70037
REEVE M. BAILEY
Museum of Zoology, The University of Michigan, Ann Arbor, MI 48109-1079
AND
HENRY L. BART, JR.
Museum of Natural History, Tulane University, Belle Chasse, LA 70037

FISHES OF THE BUFFALO RIVER SYSTEM, WILKINSON COUNTY, SOUTHWESTERN MISSISSIPPI

MARK A. WARREN
Austin Community College, Cedar Park, TX 78613
ROBERT C. CASHNER
Department of Biological Sciences, University of New Orleans, New Orleans, LA 70148
AND
ROYAL D. SUTTKUS
Museum of Natural History, Tulane University, Belle Chasse, LA 70037

FISHES OF THE TANGIPAHOA RIVER SYSTEM, MISSISSIPPI AND LOUISIANA

CHARLES L. KNIGHT
Mississippi Museum of Natural Science, 111 North Jefferson Street, Jackson, MS 39202
AND
ROBERT W. HASTINGS
Turtle Cove Environmental Research Station, P.O. Box 585, Southeastern Louisiana University, Hammond, LA 70402

Tulane
University
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Tulane University, New Orleans, Louisiana 70118

STEVEN P. DARWIN, Editor

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Museum of Natural History, Tulane University, Belle Chasse, LA 70037

ABSTRACT

Etheostoma raneyi, *E. lachneri*, and *E. ramseyi*, three new darters of subgenus *Ulocentra* occurring allopatrically in the Yazoo, Tombigbee, and Alabama River systems, respectively, are described herein. The new species are distinguished primarily on the basis of colors and color patterns of nuptial males. In *E. raneyi*, the lateral stripe is composed of elongate blotches with even ventral margins that barely extend below the lateral line. The lower side below the stripe is a uniform red-orange. *Etheostoma lachneri* males have slightly oblique green bars on the side of the body and caudal peduncle with bright orange in the interspaces between bars. *Etheostoma ramseyi* males have ovoid to quadrate lateral blotches that are connected with the dorsal saddle blotches. The orange ventrolateral coloration has dorsal extensions between the posterior lateral blotches. Males and females of the three new species also exhibit slight differences in body proportions. The three new *Ulocentra* lack a premaxillary frenum and typically have one to several teeth on the head of the vomer, as is typical of members of the *E. duryi* species group. The new forms plus *E. colorosum* and *E. tallapoosae* are suggested to form a unique subgroup within the *E. duryi* group in that they lack a red ocellus in the first interradial membrane and have incomplete bands of red and black blotches in the spinous dorsal fin. A principal components analysis revealed differences in fin dimensions among species in the five-member subgroup.

INTRODUCTION

The three species of darters described herein occur allopatrically in the Yazoo, Tombigbee, and Alabama River systems. Until formal proposal of the coastal darter (*Etheostoma colorosum* Suttkus and Bailey, 1993) one or both of the easterly distributed forms were often thought to be conspecific with that species (e.g., Kuehne and Barbour, 1983; Page and Burr, 1991). The three new species share certain characteristics that suggest a close affinity with *E. colorosum* and another nearby geographical representative, *E. tallapoosae*.

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Etheostoma colorosum occurs in coastal streams of southern Alabama and the Panhandle of Florida from the Perdido through the Choctawhatchee rivers. Populations of *E. colorosum* in western tributaries to the Escambia River system are on the east side of a low drainage divide between the Escambia River and lower eastern tributaries to the Alabama River. Thus, *E. colorosum* is isolated from the new Alabama River system species.

Etheostoma tallapoosae Suttkus and Etnier (1991) occurs in the Tallapoosa River system above the Fall Line and thus also is isolated from the new Alabama River system species, which only occurs below the Fall Line in the Alabama River system below the confluence of the Coosa and Tallapoosa rivers. However, the new Alabama River species occurs below and above the Fall Line in the Cahaba River system, a major tributary to the middle section of the Alabama River.

Identification of the three new species is based primarily on color and color pattern of nuptial males. The subgenus, *Ulocentra*, as here used, follows Bouchard (1977) and Bailey and Etnier (1988).

Materials and Methods

Specimens of the new species and comparative material used are primarily from the collections of Academy of Natural Sciences of Philadelphia (ANSP); Auburn University (AUM); Cornell University (CU); Mississippi State University (MSU); Tulane University Museum of Natural History (TU); University of Alabama (UAIC); University of Florida (UF); University of Michigan Museum of Zoology (UMMZ); National Museum of Natural History (USNM); and University of Tennessee (UT).

Counts and measurements were made as described in Hubbs and Lagler (1958) except as follows. Transverse body scales were counted from the origin of the anal fin diagonally upward to the base of the spinous dorsal fin. Gill rakers, counted on the anterior arch of either the left or the right side, include both dorsal and ventral rudiments. Measurements were made with needle-point dial calipers and recorded to the nearest 0.1 mm. Trans-pelvic width was measured between the outer bases of the pelvic spines. Our measurements of the length of the spinous dorsal, soft dorsal, and anal fins are the total lengths of these fins which is equal to the depressed lengths. Names used for associated fish species follow Robins et al. (1991), except *Etheostoma chlorosoma* (Simons, 1992).

In the listing of type material, each catalog number is followed by the number of specimens seen and the range of standard length (SL) in millimeters, e.g. (10, 22 – 56). In addition to standard compass directions (with the following "of" deleted), the following abbreviations are used: mi. = mile(s), airmi. = airmile(s), hwy. = highway, rd. = road, Cnty. = County, T = Township, R = Range, Sec = Section. In lists of materials not designated as types, the catalog number is followed by the number of specimens examined, enclosed in parentheses. Highway numbers refer to state highways unless otherwise indicated.

Etheostoma raneyi Suttkus and Bart, new species
Yazoo Darter
Figures 1, 6, 8, and 9

Etheostoma (*Ulocentra*) Bouchard, 1974: 41 (distribution). Randolph and Kennedy, 1974: 128-134 (Tippah River, Mississippi, records).

Etheostoma sp. Clemmer et al., 1975: 8 (undescribed darter species, upper Yazoo River system, Mississippi, rare). Jenkins, 1976: 644 (undescribed species, distribution).
Etheostoma (*Ulocentra*) sp. Deacon et al., 1979: 42 ("Yazoo darter," color illustration, male and female from Puskus Creek, Lafayette Cnty., Mississippi). Kuehne and Barbour, 1983: 99-100 ("Yazoo darter," briefly characterized, distribution).
Etheostoma sp. Page and Burr, 1991: 302, pl. 43, map 345 ("Yazoo darter," briefly characterized, range).

HOLOTYPE: Adult male, TU 162795, 48.3 mm standard length, Hurricane Creek, tributary to Tallahatchie River (Yazoo River system) at Mississippi Highway 7, 2.5 miles north of Oxford (T7S, R3W, Sec 28), Lafayette Cnty., Mississippi, 12 April 1992, R. D. Suttkus and H. L. Bart, Jr.

PARATOPOTYPES: TU 162796 (14, 33 – 44), collected with holotype, distributed as follows: TU 162796 (12), UMMZ 222911 (2); TU 152358 (6, 27 – 31), 19 May 1988; UT 91.3542 (64, 22 – 47), 11 March 1989, distributed as follows: UT 91.3542 (44), ANSP 170039 (2), CU 73780 (2), UMMZ 222912 (14), and USNM 325768 (2); TU 158069 (8, 32 – 41), 18 May 1990; TU 163325 (13, 34 – 44), 24 May 1992.

OTHER PARATYPES: Tallahatchie River system, Mississippi. Lafayette Cnty.: TU 152351 (18, 29 – 39), Graham Mill Creek, 0.7 mi. E Abbeville (T7S, R3W, Sec 2), 19 May 1988, distributed as follows: TU 152351 (13), UMMZ 222910 (5); TU 158058 (3, 36 – 43), 18 May 1990; TU 162809 (4, 31 – 46), 12 April 1992; TU 66140 (17, 32 – 42), Puskus Creek, tributary to Little Tallahatchie River at Hwy. 30, 7.9 mi. ENE Oxford (T8S, R2W, Sec 2), 8-9 October 1970, distributed as follows: TU 66140 (13), UAIC 10681.01 (2), UF 100285 (2); TU 77310 (2, 35 – 47), 7 April 1972; TU 83595 (4, 31 – 48), 7 September 1973; TU 84419 (11, 33 – 47), 13 October 1973, distributed as follows: TU 84419 (9), CU 73781 (2); TU 87705 (2, 37 – 43), 7 May 1974; MSU 6038 (22, 32 – 44), 5 May 1976; AUM 20651 (4, 37 – 45), spring tributary to Puskus Creek at former Minnows Inc. (T7S, R2W, Sec 34), 14 March 1980. Marshall Cnty.: TU 152338 (5, 34 – 40), Oak Chewalla Creek at Hwy. 310, 1.8 mi. W Malone (T6S, R3W, Sec 9), 18 May 1988; TU 152346 (5, 38 – 44), 19 May 1988; TU 158054 (1, 29), 18 May 1990; TU 87058 (6, 30 – 41), Little Spring Creek at Hwy. 7, 0.5 mi. SW Waterford (T5S, R3W, Sec 13), 27 October 1973; TU 87721 (1, 48), 7 May 1974; TU 152060 (1, 41), 10 May 1988; TU 84445 (1, 39), Little Spring Creek at spillway out of Little Spring Lake, 1.6 mi. N Waterford (T5S, R3W, Sec 12), 13 October 1973; TU 152328 (4, 34 – 47), Big Spring Creek at US Hwy. 78, 3.8 mi. SE of junction US Hwy. 78 and Hwy. 7 (T4S, R2W, Sec 22), 18 May 1988; UT 91.2176 (8, 31 – 47), 20 May 1981; UT 91.2167 (1, 27), Chewalla Creek, tributary to Tippah River about 5 airmi. E Holly Springs (T4S, RlW, Sec 6), 20 May 1981.

ADDITIONAL MATERIAL EXAMINED, NOT DESIGNATED AS TYPES: **Yocona River system, Mississippi.** LAFAYETTE CNTY.: TU 152109 (10), tributary to Taylor Creek at Old Taylor Rd., 1.5 mi. N Taylor (T9S, R4W, Sec 14), 11 May 1988; TU 87665 (3), Pumpkin Creek at Hwy. 334, 6.7 mi. SE Oxford (T9S, R2W, Sec 19), 6 May 1974; TU 3116 (11), Pumpkin Creek at US Hwy. 6, 6.5 mi. E Oxford (T9S, R2W, Sec 3), 24 May 1952, TU 57136 (7), 17 April 1969, TU 152051 (22), 10 May 1988, UT 91.3496 (14), 22 October 1988, TU 155716 (4), 27 July 1989, and TU 158086 (3), 18 May 1990. YALOBUSHA CNTY.: TU 155210 (26), tributary to Otoucalofa Creek at Hwy. 32, 2.5 mi. E Water Valley (T11S, R4W, Sec 15), 14 June 1989, distributed as follows: TU 155210 (21), UMMZ 222909 (5), TU 158100 (2), 18 May 1990, and TU 162832 (1), 12 April 1992; TU 155225 (3), Gordon Branch, 17.2 mi. E Water Valley (T11S, R3W, Sec 7), 15 June 1989.

DIAGNOSIS: *Etheostoma raneyi* is a member of subgenus *Ulocentra* as diagnosed by Bouchard (1977) and Bailey and Etnier (1988). Further, *E. raneyi* lacks a premaxillary frenum and the vomer usually bears a small cluster of slender teeth and in these respects is typical of members of the *E. duryi* species group of Bailey and Etnier (1988). *Etheostoma raneyi* lacks a red ocellus in the first interradial membrane of the spinous dorsal fin, as do the other two new species included in this study. The diagnostic features that distinguish the Yazoo darter are the shape and position of the blotches in the lateral stripe and the ventral-lateral coloration of the nuptial male. The more or less elongate brownish blotches are aligned along the lateral line and have rather even ventral margins that barely extend below the lateral line. The entire ventral-lateral area below the lateral stripe of the nuptial male is a uniform reddish-orange. The red coloration in the spinous dorsal fin is restricted to the posterior three to five interradial membranes. There is an incomplete band of black blotches that extends from the first to the seventh or eighth interradial membrane. These black blotches are closer to the base of the fin than the aforementioned red blotches.

DESCRIPTION: *Etheostoma raneyi* reaches a maximum of 45 mm SL (females) to 50 mm SL (males). Sexual dimorphism and apparent sexual maturity occur at the end of the first year at a minimum of 28 mm SL (females) and 30 mm SL (males).

Frequency distributions of scale and fin ray counts are presented in Tables 1-5. Number of vertebrae, branchiostegal rays, gill rakers, and preoperculomandibular pores are given in Tables 6-7. The lateral line is usually complete with (41 –) 43 – 49 (– 53) scales, occasionally the last scale is unpored. Transverse scales 11 (2 specimens), 12 (36), 13 (57), 14 (51), 15 (16), or 16 (3). Caudal peduncle scale rows number 15 (16), 16 (57), 17 (75), 18 (13) or 19 (4). Dorsal fin has (9 –) 10 – 11 (– 12) spines and (9 –) 10 – 11 (– 12) soft rays. Anal fin has 2 spines and (6 –) 7 – 8, modally 7, soft rays. Pectoral fin has (13 –) 14 – 15 rays. Vertebrae number 37 (8), 38 (41), or 39 (7); branchiostegal rays number 5—5 (149), 6—5 (4), 5—6 (6), or 6—6 (6); and gill rakers on first arch number 8 (6), 9 (19), or 10 (5). The sum of left and right preoperculomandibular pores is nearly constant at 18 (in 26 of 30 specimens), of the remaining four, one has 16 pores and three have 17 pores. The opercle, cheek, and nape typically are

TABLE 1. Frequency distribution of transverse scale rows (anal to spinous dorsal) in three species of *Ulocentra*.

	11	12	13	14	15	16	17	N	$\bar{x}$	S.D.
Etheostoma raneyi	2	36	57	51	16	3		165	13.3	1.0
Etheostoma lachneri	2	21	45	45	33	8	1	155	13.7	1.1
Etheostoma ramseyi		11	48	44	35	8	4	150	13.9	1.1

TABLE 2. Frequency distribution of number of scales around caudal peduncle in three species of *Ulocentra*.

	14	15	16	17	18	19	20	N	$\bar{x}$	S.D.
Etheostoma raneyi		16	57	75	13	4		165	16.5	0.8
Etheostoma lachneri	1	23	35	97	37	18	2	213	17.0	1.1
Etheostoma ramseyi	2	20	45	85	45	12	3	212	16.9	1.1

TABLE 3. Frequency distribution of lateral-line scale counts in three species of *Ulocentra*.

	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	N	$\bar{x}$	S.D.
Etheostoma raneyi			1	7	15	24	34	25	32	11	11	1	2	1	1	165	45.7	2.1
Etheostoma lachneri	3	5	17	18	24	25	37	30	22	15	11	3	2			212	44.8	2.5
Etheostoma ramseyi		1	4	12	20	22	30	41	35	24	12	6	1	2	2	212	45.8	2.3

TABLE 4. Frequency distribution of dorsal fin ray counts in three species of *Ulocentra*.

	Dorsal spines								Dorsal soft rays							
	8	9	10	11	12	N	$\bar{x}$	S.D.	9	10	11	12	13	N	$\bar{x}$	S.D.
Etheostoma raneyi		14	114	35	2	165	10.1	0.5	1	50	105	9		165	10.7	0.5
Etheostoma lachneri		11	136	50	4	201	10.2	0.5		5	130	64	2	201	11.3	0.5
Etheostoma ramseyi	1	4	78	88	3	174	10.5	0.6		9	117	47	1	174	11.2	0.5

TABLE 5. Frequency distribution of fin ray counts in three species of *Ulocentra*.

	Anal soft rays							Left pectoral rays						
	6	7	8	9	N	$\bar{x}$	S.D.	13	14	15	16	N	$\bar{x}$	S.D.
Etheostoma raneyi	11	133	21		165	7.1	0.4	11	126	28		165	14.1	0.4
Etheostoma lachneri	2	123	74	1	201	7.4	0.5	4	106	90	1	201	14.4	0.5
Etheostoma ramseyi	20	118	12		150	6.9	0.4	20	114	16		150	13.9	0.4

covered with exposed scales. The prepectoral area typically is covered with scales. The breast is usually naked but occasionally has one or a few scales, and the belly is completely covered with exposed scales.

In 10 specimens dissected for dentition, the vomer lacks teeth in one, the head of the bone has two slender teeth in two, three in two, four in two, five in two, six in one, mean 3.4 teeth. All 10 lack palatine teeth.

Proportional measurements appear in Tables 8-9. The 25 males were from thirteen collections representing six different small stream systems. These collections were obtained during the months of April, May, June, September, and October and thus represent nuptial and non-nuptial conditions. All proportional measurements of the holotype are within the ranges given in Table 8. The 10 females were from six collections representing five different stream systems obtained during April, May, and June and thus also represent nuptial and post-nuptial conditions.

Colors of live and freshly preserved nuptial males, collected in March and April are described from Hurricane Creek (Figure 1). Additional color descriptions are provided for specimens collected in May from Hurricane, Graham Mill, Pumpkin, Big Spring, and Taylor creeks. The entire lower side from the midventral area up to the lower margin of the lateral stripe is orange to red-orange color in large nuptial males. Small males, particularly in May collections, have a varying amount of orange on the lower side, ranging from a narrow stripe to a broad band that extends from axil of pectoral fin to the mid-area of the caudal peduncle. The lateral stripe is composed of either a single or double row of quadrate to oblong blotches. The single series exhibits a gradation from red posteriorly to russet to brown anteriorly. This single row of blotches is aligned along the upper margin of the lateral line in the posterior section but more nearly straddles the lateral line anteriorly. Where a double row of blotches occurs, the secondary series is composed of small brown blotches that border the lower edge of the lateral line and typically occur in the interspaces between the larger blotches. These two series of blotches are more or less suffused into a single band at the height of nuptial coloration. This suffusion tends to dull the brightness of the red-colored blotches in the posterior section of the primary series. Posteriorly, some of the interspatial areas are overlaid with greenish-gray pigment that extends ventrad from the dorsal-lateral area. The greenish-gray pigment is usually in bar-shaped blotches on the caudal peduncle and base of caudal fin and may extend slightly below the lower margin of the lateral stripe. There is a scattering of irregularly shaped brown blotches along the dorsal-lateral area. The mid-dorsal saddle blotches usually number eight and have a greenish tinge in the nuptial male. The top of the head is dark brown. The ventral surface of the head from the breast to the snout tip is pale and overlaid with turquoise. The cheek, breast, gill membranes, lower part of opercle, and side of snout are turquoise in color. There is a dark brown preorbital bar, a dark brown suborbital bar, and several brown blotches along upper margin of opercle.

Nuptial males have turquoise color in all fins except the pectorals. Nearly the entire anal and pelvic fins are turquoise, with tips of the spines and soft rays milky white. Two nuptial males from Hurricane Creek had a small red spot in the posterior basal part of the anal fin. The margins of the caudal and first and second dorsal fins are turquoise. The procurrent margins of the caudal fin are more intense turquoise than the posterior margin. There are two orange to red-orange blotches at the base of the caudal fin. The marginal band of tur-

quoise in the second dorsal fin is considerably broader than that in the spinous dorsal fin. Proximally from the turquoise margin of the spinous dorsal fin there are two distinct series of blotches. Posteriorly in the mid-portion of the fin there is a series of red blotches; these number from three to six and are centered on the interradial membranes. The posterior blotches are relatively large and diminish abruptly in size in the successive membranes anteriorly; there is some pale cream to yellow color around the distal and proximal margins of the red blotches. The other series of blotches is black; it extends from the first interradial membrane to the sixth or seventh, and occurs in the basal half of each interradial membrane (Figure 1). The posterior one to three black blotches are proximal to the anteriormost red blotches described above.

Nuptial females have very little chromatic coloration. Occasionally a female will have a few flecks of red in the posterior interradial membranes of the first dorsal fin, three or four flecks of red in posterior interradial membranes of the second dorsal fin, and more often will have upper and lower orange blotches at the caudal fin base. Nearly all the pigmentation involves different shades of brown. The blotches that compose the lateral stripe or band often are in one series but occasionally form an interconnected double series. The latter pattern usually has extensions above and below the lateral line. Females with a single series of blotches have most of the pigment extending below the lateral line. Regardless of whether the single or double pattern is present, the ventral margin of the lateral stripe is more uneven in females than in nuptial males. Perhaps the primary reason is that no suffusion or overlay of pigmentation occurs in the females.

DISTRIBUTION: *Etheostoma raneyi* is confined to tributaries to the Tallahatchie and Yocona river systems in north-central Mississippi (Figures 6, 9). Both rivers drain into the Yazoo River system. All of our material (five sites in the Yocona River system and ten in the Tallahatchie River system) is from the northern part of the North Central Plateau physiographic district (Lowe, 1925: 22-27). Our earliest record is that by R. D. Suttkus and two students on 24 May 1952, when eleven specimens were obtained from Pumpkin Creek, a tributary to Yocona River. Additional collections were made periodically up to the present time. Randolph and Kennedy (1974), in a study of the Tippah River system, reported samples from several sites in the upper part of that system. Their easternmost locality occurs in the northern part of the Flatwoods physiographic district (Figure 6). Kenneth W. Thompson and Robert J. Muncy were sponsored by the U. S. Fish and Wildlife Service to compile a status report of the "Yazoo River Darter," *Etheostoma* (*Ulocentra*) sp. Collections were obtained during the period from 1980 to 1984. The report is undated but was submitted to the contractor early in 1985. They found the "Yazoo River Darter" at three sites in the Yocona River system and 14 sites in the Little Tallahatchie River system. They reported a total of 195 specimens, ranging from 20 – 61 mm SL. None of the specimens collected by Randolph and Kennedy nor by Thompson and Muncy was available to us. No other species of subgenus *Ulocentra* occurs within the range of *E. raneyi*.

HABITAT AND BIOLOGY: Hurricane Creek at Hwy. 7 (type locality) is a multiple-channel stream that flows through a marsh area that varies from about 80 to more than 100 feet in width. There are several sets of beaver dams on the upstream side of the highway. Much of the area is laden with a thick layer of loose organic debris. There is an abundance of bur reed, *Sparganium* sp., along

TABLE 6. Frequency distribution of number of vertebrae and number of branchiostegal rays in three species of *Ulocentra*.

	Vertebrae							Branchiostegal rays							
	37	38	39	40	N	x̄	S.D.	4—4	5—3	5—4	5—5	6—5	5—6	6—6	N
Etheostoma raneyi	8	41	7		56	38.0	0.5				149	4	6	6	165
Etheostoma lachneri	11	66	13	2	92	38.1	0.6			1	201	4	3	4	213
Etheostoma ramseyi	23	88	19		130	37.9	0.5	1	1	3	181		2	1	189

TABLE 7. Number of gill rakers on first left arch and total number of preoperculomandibular pores (both sides) in three species of *Ulocentra*.

	Gill rakers									Preoperculomandibular pores (both sides)						
	6	7	8	9	10	11	N	x̄	S.D.	16	17	18	19	N	x̄	S.D.
Etheostoma raneyi			6	19	5		30	9.0	0.6	1	3	26		30	17.8	0.4
Etheostoma lachneri	7	32	90	44	8	1	182	8.1	0.8	1	8	187	2	198	17.9	0.2
Etheostoma ramseyi	6	20	43	78	36	3	186	8.7	1.0	1	7	171		179	17.9	0.2

TABLE 8. Measurements in thousandths of standard length for *Etheostoma raneyi, E. lachneri, E. ramseyi, E. colorosum*, and *E. tallapoosae* males.

	E. raneyi (N = 25)			*E. lachneri* (N = 25)			*E. ramseyi* (N = 25)			*E. colorosum* (N = 25)			*E. tallapoosae* (N = 25)		
	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D
Standard length (mm)	39.1-49.8	44.4	2.8	37.2-51.5	42.9	3.5	40.4-47.5	44.1	2.2	40.6-53.5	47.9	3.5	43.2-61.2	48.8	3.8
Head length	248-273	260	7.2	237-273	257	9.2	239-265	252	5.9	242-272	257	8.3	236-262	249	8.1
Body depth	193-223	205	8.7	186-218	206	7.2	177-215	198	11.3	177-224	194	9.8	191-220	203	8.6
Snout length	65-79	70	3.6	60-78	70	5.4	66-76	71	2.5	66-81	73	3.3	66-79	72	4.0
Orbit length	62-72	68	3.0	61-76	69	3.5	61-69	66	2.4	63-75	68	2.8	57-67	63	2.6
Spinous dorsal fin length	276-309	292	9.9	255-314	291	14.2	259-310	291	13.3	273-319	300	12.3	265-308	290	10.6
Longest dorsal spine	121-151	131	7.0	113-158	136*	11.1	112-143	125	8.0	133-182	154	11.1	99-142	120	10.9
Soft dorsal fin length	249-298	273	13.7	266-322	291	16.2	238-303	276	17.5	281-338	308	16.1	242-276	260	9.3
Longest dorsal soft ray	123-167	151	10.4	122-174	154	11.9	126-160	148	8.3	150-191	166	10.9	114-146	134	7.7
Caudal peduncle length	273-319	292	10.8	264-307	287	11.1	278-325	306	11.2	291-317	305	7.2	293-328	310	9.0
Caudal peduncle depth	95-112	103	4.7	98-114	105	4.3	97-113	104	4.7	92-112	98	5.0	99-113	106	3.7

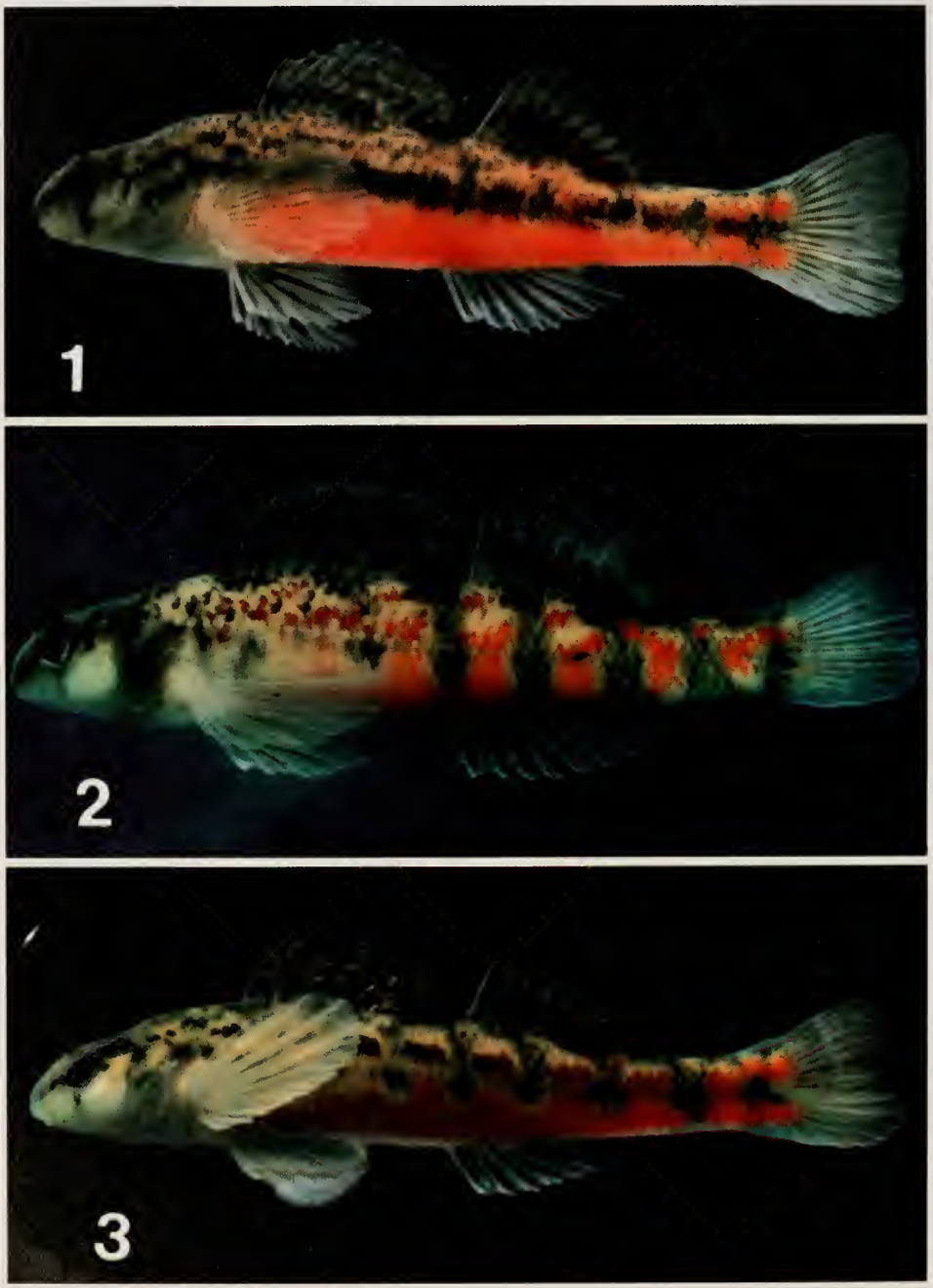
Anal fin length	237-279	263	10.1	247-288	265	12.1	224-265	248	14.0	264-307	280	10.5	227-276	246	11.4
First anal spine length	67-84	77	5.4	67-92	80	6.6	66-83	75	5.2	50-91	72	8.5	61-76	66	3.7
Longest anal soft ray	114-155	141	10.3	118-156	137	11.2	112-146	130	10.0	134-168	146	8.0	111-144	129	7.8
Caudal fin length	204-241	224	9.8	203-263	226	13.5	181-233	217	10.8	210-245	228	9.6	176-216	202	10.9
Pectoral fin length	246-295	271	12.5	238-295	275	14.5	222-292	270	15.1	260-343	290	18.7	221-271	250	14.3
Pelvic fin length	201-242	224	10.1	185-238	219	12.5	190-233	219	10.3	200-250	221	11.6	194-245	220	10.6
Trans-pelvic width	83-96	88	3.1	75-90	84	3.4	78-91	86	3.4	77-93	84	4.1	74-87	82	2.7
Maximum body width	122-156	134	9.4	119-174	132	7.0	112-155	138	11.4	123-156	137	7.2	126-164	142	7.4
Interorbital width	42-51	46	2.2	39-52	46	3.1	43-49	46	1.6	39-50	44	2.7	41-48	44	1.9

*based on 24 specimens

TABLE 9. Measurements in thousandths of standard length for *Etheostoma raneyi*, *E. lachneri*, *E. ramseyi*, *E. colorosum*, and *E. tallapoosae* females.

	E. raneyi (N = 10)			*E. lachneri* (N = 10)			*E. ramseyi* (N = 10)			*E. colorosum* (N = 10)			*E. tallapoosae* (N = 10)		
	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.	Range	x̄	S.D.
Standard length (mm)	40.0-45.1	42.3	1.7	39.2-45.5	41.4	1.8	40.5-44.2	42.8	1.2	38.6-47.1	43.4	2.5	38.2-45.5	42.6	2.3
Head length	239-266	254	7.7	243-266	252	7.7	241-256	247	5.1	238-267	255	9.3	238-257	245	6.1
Body depth	184-232	218	14.5	202-245	216	13.5	197-216	208	5.5	181-224	199	16.6	198-219	211	9.1
Snout length	65-76	69	3.5	61-72	66	4.1	64-73	69	2.8	63-76	71	3.6	68-73	70	1.9
Orbit length	67-76	73	3.2	63-71	66	2.6	63-69	66	2.0	71-83	74	3.7	63-68	65	1.5
Spinous dorsal fin length	260-295	280	12.6	265-294	279	9.3	265-302	282	11.8	265-302	280	12.6	263-290	275	8.9
Longest dorsal spine	115-140	124	8.2	103-125	111	6.1	97-116	105	6.4	107-130	116	6.9	96-114	108	5.9
Soft dorsal fin length	264-282	267	10.4	234-290	268	15.9	259-280	267	7.3	269-307	286	11.8	240-262	251	6.9
Longest dorsal soft ray	149-165	157	5.4	122-156	143	10.5	136-151	140	4.8	142-158	151	5.1	126-156	138	8.9
Caudal peduncle length	279-316	294	10.6	267-301	281	12.0	284-303	292	6.0	280-314	293	10.0	299-316	305	9.2
Caudal peduncle depth	93-103	99	3.8	90-106	96	5.8	95-102	99	2.1	84-101	91	6.0	97-104	101	1.9
Anal fin length	242-268	252	9.7	233-270	244	13.2	231-252	240	7.4	232-272	248	13.6	220-261	237	13.6
First anal spine length	62-88	78	7.7	63-76	68	4.8	60-76	67	5.3	54-68	60	4.2	61-70	65	2.8
Longest anal soft ray	127-163	145	10.5	107-147	125	11.7	118-141	131	7.5	116-140	128	8.1	113-142	126	9.2
Caudal fin length	208-234	221	8.2	175-236	210	21.4	210-225	217	5.6	213-241	222	9.6	194-222	204	8.0
Pectoral fin length	250-297	271	11.9	230-294	266	20.3	274-301	285	11.6	261-331	294	18.6	236-273	255	11.3
Pelvic fin length	213-237	223	7.2	185-230	213	14.5	195-217	209	6.3	197-242	209	13.1	201-233	215	9.7
Trans-pelvic width	81-91	87	3.8	75-84	82	2.7	81-88	86	1.8	77-83	80	2.1	80-87	83	2.3
Maximum body width	134-166	150	10.8	125-174	147	17.3	141-162	156	7.0	130-159	143	8.8	139-170	153	13.1
Interorbital width	45-49	47	1.7	42-51	45	3.2	42-50	47	2.3	39-47	44	2.6	42-47	44	1.6

the main channel (10 – 15 feet in width) and along short stretches of lesser channels. Also, there is an abundance of emergent aquatic plants along the margins of the marshy stream system. Intermittently there are patches of sand substrate along the main and lesser channels. Most of the Yazoo darters were collected from near these patches of sand substrate.



Figures 1-5. *Etheostoma* species from Mississippi, Alabama, and Florida. 1. *E. raneyi*, TU 162795, holotype, adult male, 48 mm SL. Hurricane Creek, tributary to Tallahatchie River at Hwy. 7, 2.5 mi. N Oxford, Lafayette Cnty., Mississippi. Photo by Suttkus and Bart. 2. *E. lachneri*, TU 157555, paratopotype, adult male, 45 mm SL. Wolf Creek, tributary to Little Souwilpa Creek at Hwy. 17, 1.0 mi. N Silas at US Hwy. 84, Choctaw Cnty., Alabama. Photo by Pierson. 3. *E. ramseyi*, TU 162574, holotype, adult male, 49 mm SL. Beaver Creek at Wilcox Cnty. Rd. 27, 0.8 mi. W Sunny South, Wilcox Cnty., Alabama. Photo by Suttkus. 4. *E. tallapoosae*, TU 157803, paratype, adult male, 55 mm SL. Gold Branch, tributary to Channahatchee Creek at Hwy. 63, 6.0 mi. N Eclectic, Elmore Cnty., Alabama. Photo by Suttkus and Pierson. 5. *E. colorosum*, TU 162508, holotype, adult male, 50 mm SL. Pine Barren Creek, tributary to Escambia River, Escambia Cnty., Florida. Photo by Suttkus.

Water temperature in Hurricane Creek rises earlier in the spring than in other nearby tributaries. On 11 March 1989 the water temperature was 16° C and numerous Yazoo darters, nuptial males and females, were collected. On the same day, Pumpkin (8° C) and Graham Mill (12° C) creeks were sampled. No males and only a few females were collected. Other temperature records for Hurricane Creek during which Yazoo darters were collected are as follows: 12 April 1992, 16° C; 18 May 1990, 21° C; 19 May 1988, 19° C; and 24 May 1992, 19° C. Water temperature records for 31 collections (including those cited above) of Yazoo darters taken between 24 May 1952 and 24 May 1992 range from 16°

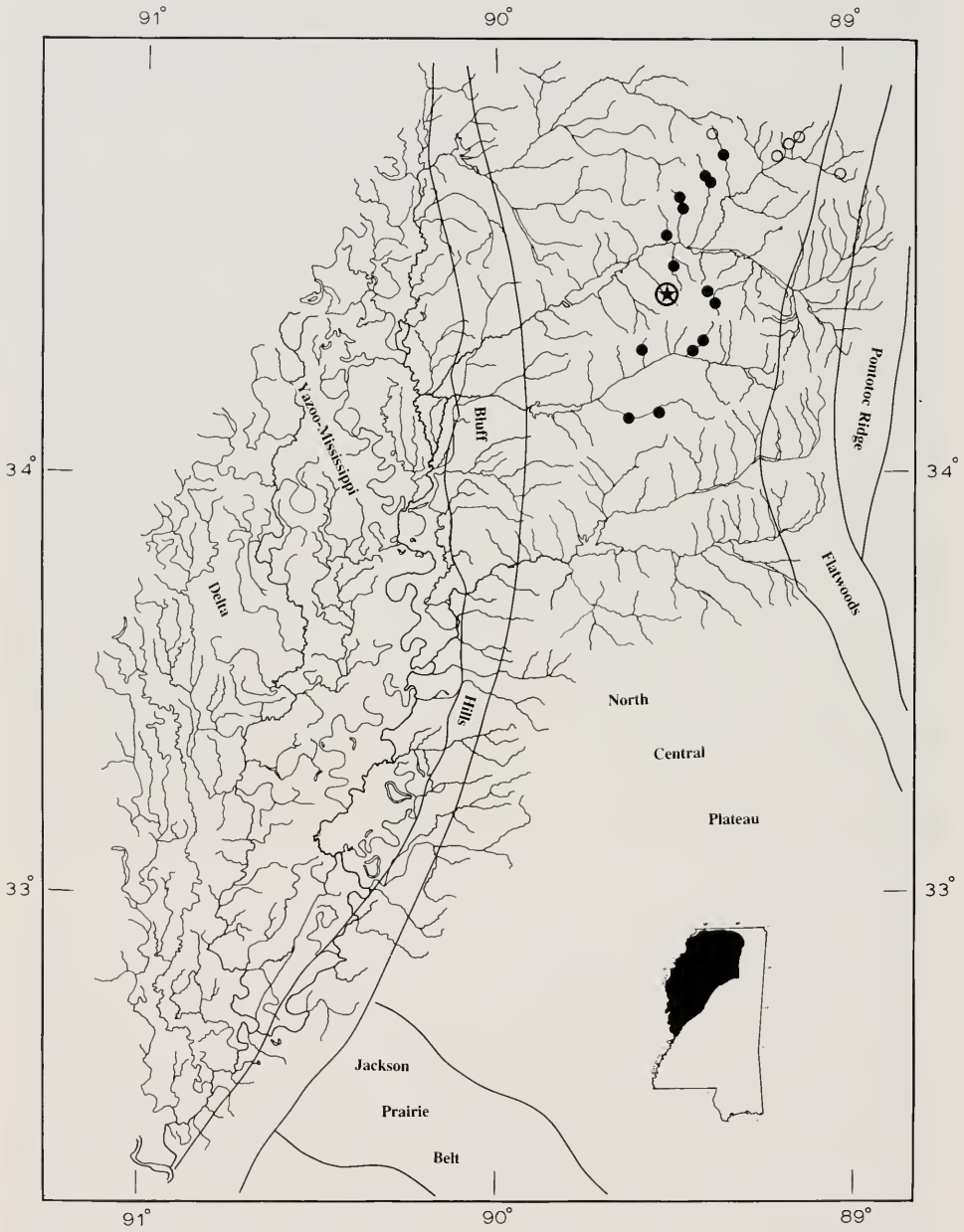


Figure 6. Distribution of *Etheostoma raneyi* in Mississippi (solid dots = material used in our study; star in open circle = type locality; open circles = Randolph and Kennedy collection sites).

to 26° C. Two collections made at 25° C yielded four specimens each and one collection at 26° C resulted in a single specimen. Observations on site, color notes, and photos indicate that most spawning takes place during early spring (March and April into May) with rising temperatures and tapers off or ceases when water temperatures go above 20° or 21° C.

Little and Big Spring creeks are similar to Hurricane Creek in that both have an abundance of vegetation, primarily bur reed. Puskus and Oak Chewalla creeks have primarily sand substrates with few or no aquatic plants. Graham Mill and Taylor creeks have a mixture of sand and gravel substrate with man-deposited rubble at the bridge crossings and no aquatic vegetation. The tributary to Otoucalofa Creek, 2.5 miles E Water Valley, has rubble at the bridge crossing (where the Yazoo darters were obtained), sand and silted bottom upstream, and sand and some hard clay bottom downstream with no aquatic vegetation. Most of the streams inhabited by Yazoo darters are spring-fed as pointed out by Thompson and Muncy in their status report. Many other sites within the Tallahatchie and the Yocona river systems were sampled without obtaining Yazoo darters. Invariably these sites were distant from spring sources, were disturbed frequently by channelization, or had most or all the marginal vegetation removed from banks. Individually and together these factors contribute to higher water temperatures and unstable substrate, both conditions that appear to be unsuitable for Yazoo darters.

The species associates of *Etheostoma raneyi* at the type locality based on four collections are as follows: *Lampetra aepyptera, Esox americanus, Erimyzon oblongus, Cyprinella venusta, Lythrurus fumeus, Notemigonus crysoleucas, Noturus phaeus, Fundulus olivaceus, Aphredoderus sayanus, Lepomis cyanellus, L. gulosus, L. macrochirus, L. marginatus, L. punctatus, Micropterus salmoides, Etheostoma chlorosoma, E. lynceum, E. nigrum, E. parvipinne, E. proeliare, E. swaini*, and *Percina sciera*.

ETYMOLOGY: We take pleasure in naming this darter, *Etheostoma raneyi*, for the late Edward C. Raney in recognition of his numerous contributions to our knowledge of the systematics and biology of darters. He had an intense interest in darters and passed on his enthusiasm for them to a number of his students. Dr. Raney authored or coauthored seven original descriptions of darters between the years 1939-1967.

Etheostoma lachneri Suttkus and Bailey, new species
Tombigbee Darter
Figures 2, 7, 8, and 9

Etheostoma (*Ulocentra*) sp. Smith-Vaniz, 1968: 136 (in part, reports from Black Warrior, upper and lower Tombigbee rivers). Jenkins, 1976: 644 (in part, distribution). Knight and Cooper, 1987: 31, 33, 36, 38 (records in Otoucalofa Creek, Mississippi, habitat). Hubbard, et al. 1991: 3-8, 11 (records in Sucarnoochee River system). Boschung, 1992: 122 (in part, "orangestripe darter," a complex of species).

Etheostoma sp. Mettee et al., 1983: 24 (in part), 26, 79, 82, 84, 86 (records from Citronelle and Gilbertown oil fields, Alabama). O'Neil et al., 1984: 26 (distribution and abundance in Citronelle oil field, Alabama). Mettee et al., 1986: 19, 32 (records and abundance in Gilbertown oil field, Alabama). Page, 1983: pl. 16G, 16H (in part, Minter Creek, Alabama, record). Boschung, 1987: 187, 191 (distribution in upper Tombigbee River system, frequency of occurrence, relative abundance). Page and Burr, 1991: 302, pl. 43, map 346 ("Coastal Plain Darter," in part, briefly characterized, range).

Etheostoma sp. A. Mettee, 1978: 149 (habitat, distribution). Mettee et al., 1987: map (distribution, species associates, habitat). Mettee et al., 1989a: 18, 19, 33-46, 188, map (Black Warrior River system records, species associates, habitat). Mettee et al., 1989b: 152 (distribution).

Etheostoma sp. (*colorosum*) Hubbard, 1987: 24-26 (*nomen nudum*; misidentification; Noxubee River system, Mississippi).

HOLOTYPE: Adult male, TU 162631, 41.6 mm standard length, Wolf Creek, tributary to Little Souwilpa Creek at Alabama Highway 17, 1.0 mile north of Silas at US Highway 84 (T10N, R3W, Sec 31), Choctaw Cnty., Alabama, 1 April 1992, R. D. Suttkus.

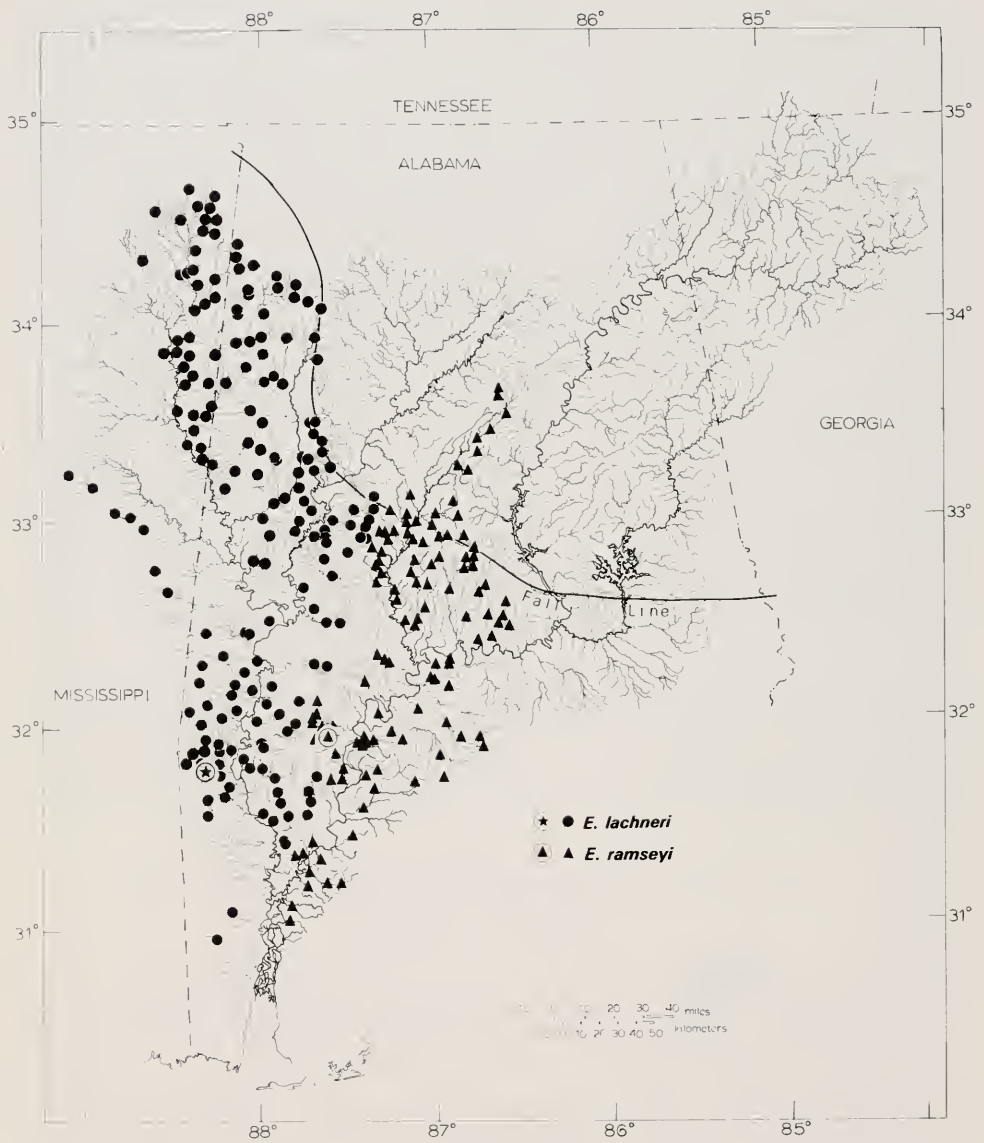


Figure 7. Distribution of *Etheostoma lachneri* and *E. ramseyi* in the Mobile River Basin of Mississippi, Alabama, Georgia, and Tennessee (star or triangle in open circle = type localities).

PARATOPOTYPES: TU 162632 (30, 33 – 44), collected with holotype, distributed as follows: TU 162632 (26), UMMZ 222913 (4); TU 56964 (43, 27 – 43), 22 March 1969, distributed as follows: TU 56964 (33), ANSP 170040 (2), CU 73782 (2), UAIC 10682.01 (2), UF 100286 (2), USNM 325769 (2); TU 151624 (50, 26 – 41), 9 April 1988; TU 152517 (75, 28 – 41), 26 May 1988, distributed as follows: TU 152517 (65), UMMZ 222914 (10); TU 154427 (30, 32 – 46), 2 February 1989; UT 91.3567 (64, 33 – 45), 12 March 1989; TU 154488 (8, 35 – 46), 22 March 1989; TU 157555 (34, 33 – 45), 22 March 1990; TU 162344 (12,

35 – 48), 1 March 1992; TU 162558 (17, 35 – 49), 30 March 1992; TU 166059 (11, 30 – 46), 22 November 1992; TU 166419 (31, 32 – 46), 7 February 1993; TU 166579 (57, 29 – 40), 25 March 1993; TU 166720 (31, 31 – 44), 16 April 1993.

Other Paratypes: TU 56990 (21, 28 – 42), Souwilpa Creek at Hwy. 17, 3.9 mi. S Gilbertown (T10N, R3W, Sec 19), 22 March 1969; TU 76820 (1, 41), Puss Cuss Creek, tributary to Okatuppa Creek at Hwy. 14, 4.2 mi. W Gilbertown (T11N, R4W, Sec 28), 31 March 1972; TU 57007 (1, 32), Bogueloosa Creek at Hwy. 17, 0.8 mi. N Toxey (T11N, R3W, Sec 17), 22 March 1969; TU 76831 (4, 31 – 39), tributary to Bogueloosa Creek at Hwy. 18, 0.6 mi. W Needham (T12N, R4W, Sec 26), 31 March 1972.

Additional material examined, not designated as types: **Tombigbee River system. Alabama.** Mobile Cnty.: TU 2598 (2), Sand Hill Creek, tributary to Chickasaw Creek at US Hwy. 45, 6.7 mi. S Citronelle (T1S, R3W, Sec 12), 4 June 1951, TU 32392 (51), 27 May 1964, and TU 162332 (3), 1 March 1992; TU 162324 (5), Cedar Creek at Hwy. 96, 4.8 mi. ENE Citronelle (T2N, R2W, Sec 22), 1 March 1992. Washington Cnty.: TU 32409 (4), Taylors Creek, tributary to Santa Bogue Creek at Hwy. 17, 10.2 mi. N Chatom (T7N, R3W, Sec 8), 27 May 1964; TU 162652 (7), Dunbar Creek at Hwy. 17, 1.7 mi. N Millry (T8N, R3W, Sec 17), 1 April 1992. Clarke Cnty.: TU 41434 (161), Salt Creek at Clarke Cnty. Rd. 15, 4.5 mi. S Jackson (T6N, R2E, Sec 34), 30 June 1966, TU 151775 (25), 16 April 1988, and TU 162395 (17), 2 March 1992; TU 32519 (20), tributary to Salt Creek at Clarke Cnty. Rd. 15, 4.4 mi. S Jackson (T6N, R2E, Sec 34), 29 May 1964; TU 45503 (3), Rabbit Creek, tributary to Bassett Creek, 2.7 mi. NE Jackson (T7N, R2E, Sec 14), 16 April 1967; TU 32466 (30), Bassett Creek, 2.0 mi. W Suggsville (T7N, R3E, Sec 12), 28 May 1964; TU 35314 (82), Bassett Creek at US Hwy. 84 at Allen, 8.0 mi. SE Grove Hill (T7N, R3E, Sec 12), 2 July 1964; TU 152481 (19), Little Bassett Creek at Clarke Cnty. Rd. 30, 1.1 mi. E Dickinson (T9N, R4E, Sec 8), 26 May 1988; TU 59930 (29), Stave Creek at Hwy. 69, 5.4 mi. NW Jackson (T7N, R1E, Sec 25), 24 September 1969; TU 59959 (45), Jackson Creek at Hwy. 69, 9.7 mi. NW Jackson (T7N, R1E, Sec 9), 25 September 1969, and MSU 1437 (13), 2 July 1970; TU 56939 (4), Tattilaba Creek at US Hwy. 84, 7.4 mi. W Grove Hill (T9N, R2E, Sec 32), 19 March 1969; TU 43195 (2), Ulkinask Creek at Clarke Cnty. Rd. 1, 2.0 mi. WNW Coffeeville (T10N, R1W, Sec 33), 3 February 1967; TU 52128 (28), Pace Creek at Hwy. 69, 5.2 mi. N Coffeeville (T10N, R1W, Sec 20), 23 May 1968; TU 52145 (34), Tallahatta Creek at Hwy. 69, 1 mi. SW Campbell (T11N, R1E, Sec 20), 23 May 1968. Choctaw Cnty.: TU 52111 (5), Bladen Springs Run at Bladen Springs Park, 1 mi. NE town of Bladen Springs (T9N, R2W, Sec 20), 23 May 1968, and TU 56951 (5), 19 March 1969; TU 76878 (8), Wahalak Creek at Hwy. 17 at south edge of Butler (T13N, R2W, Sec 30), 31 March 1972. Marengo Cnty.: TU 24539 (6), North and South Double Creek at Hwy. 69, 3 mi. N junction of Hwy. 69 and Hwy. 10 (T14N, R1E, Sec 34), 27 March 1961; TU 60931 (13), Beaver Creek at Hwy. 69, 11.9 mi. SW Linden (T15N, R1E, Sec 36), 18 December 1969; TU 163228 (20), Beaver Creek at US Hwy. 43, 5.8 mi. N Dixons Mill (T14N, R3E, Sec 34), 11 May 1992, TU 166593 (3), 26 March 1993, and TU 166748 (6), 17 April 1993. Sumter Cnty.: UMMZ 97797 (29), Sucarnoochee Creek, SE Coatopa (T17N, R1W, Sec 6), 1 July 1931. Greene Cnty.: AUM 26795 (1), Brush Creek at Greene Cnty. Rd. 133, SW Eutaw (T21N, R1E, Sec 3), 19 August 1990; TU 166606 (13), Minters Creek at Greene Cnty. Rd. 213, 9.7 mi. N Eutaw (T23N, R2E, Sec 13), 26 March 1993, and TU 166762 (8), 17 April 1993. Hale Cnty.: TU 61373 (50), Elliotts Creek at Hwy. 69 at Moundville (T23N, R5E, Sec 6), 20 December 1969, and AUM 26308 (7), 2 February 1990. Tuscaloosa Cnty.: UMMZ 177746 (17), tributary to Black Warrior River at Hwy. 69, 2.5 mi. N Tuscaloosa (T21S, R5E, Sec 10), 23 May 1956; TU 30194 (12), Carroll Creek at Hwy. 69, 5 mi. N Northport (T20S, R10W, Sec 22), 10 April 1963; UMMZ 166363 (12), Carroll Creek at detour US Hwy. 43, 5 mi. N Tuscaloosa (T20S, R10W, Sec 20), 4 May 1952; UMMZ 166373 (8), Binnion Creek at US Hwy. 43, 5.5 mi. S Samantha (T19S, R10W, Sec 16), 4 May 1952. Pickens Cnty.: TU 154442 (1), Little Bear Creek just off US Hwy. 82 at western edge of Gordo (T20S, R13W, Sec 9), 11 March 1989; TU 77044 (21), Bear Creek, tributary to Lubbub Creek, 2.0 mi. NNW Gordo (T20S, R13W, Sec 5), 3 April 1972; TU 76961 (1), Lindsey Branch, tributary to Tombigbee River, 6.6 mi. N Pickensville (T20S, R17W, Sec 13), 2 April 1972. Lamar Cnty.: MSU 3882 (5), Luxapalila River at Hwy. 17, N Millport (T17S, R15W, Sec 14), 17 November 1973; TU 163077 (3), Hells Creek at Lamar Cnty. Rd. 41 (T15S, R14W, Sec 23), 30 April 1992. Fayette Cnty.: TU 163098 (2), Hells Creek at Hwy. 18, NW Fayette (T15S, R13W, Sec 17), 30 April 1992. Marion Cnty.: TU 30225 (10), New River at US Hwy. 78 about 4 mi. W Elridge (T13S, R11W, Sec 10), 10 April 1963; TU 19080 (2), North Fork Creek at US Hwy. 43, 10.2 mi. NNE Hamilton (T9S, R13W, Sec 33), 22 August 1958. **Missis-**

sippi. LAUDERDALE CNTY.: UMMZ 113865-6 (15), Ponta Creek, tributary to Sucarnoochee Creek at US Hwy. 45, 12 mi. S Electric Mills (T8N, R17E, Sec 24), 3 June 1932. KEMPER CNTY.: TU 127832 (4), Sucarnoochee Creek at Hwy. 16, 8.7 mi. W Scooba (T11N, R17E, Sec 19), 10 October 1982. WINSTON CNTY. MSU 999 (6), tributary to Hashuqua Creek at Hwy. 14, 2 mi. W Noxubee Cnty. line (T14N, R14E, Sec 3), 24 May 1970. CHOCTAW CNTY.: MSU 722 (9), tributary to Noxubee River about 2 mi. SE Choctaw Lake (T16N, R11E, Sec 2), 21 November 1969. LOWNDES CNTY.: TU 76945 (2), Ellis Creek, tributary to Tombigbee River about 6 mi. S Columbus (T19S, R17W, Sec 17), 2 April 1972; TU 83698 (1), Tombigbee River at Buzzard Island (before impoundment) (T19S, R18W, Sec 9), 8 September 1973; AUM 3349 (2), tributary to Buttahatchie River about 5 mi. N Caledonia (T15S, R17W, Sec 22), 2 October 1968.

DIAGNOSIS: *Etheostoma lachneri* is a member of subgenus *Ulocentra* as diagnosed by Bouchard (1977) and Bailey and Etnier (1988). *Etheostoma lachneri* lacks a premaxillary frenum and the vomer usually has a small cluster of two to five or six teeth, occasionally lacking, as is typical of members of the *E. duryi* species group of Bailey and Etnier (1988). *Etheostoma lachneri* lacks a red ocellus in the first membrane of the spinous dorsal fin. The unique diagnostic features of *E. lachneri* are the slightly oblique, dark green bars on the side of body and caudal peduncle, and the bright orange interspaces of the nuptial males. *Etheostoma lachneri* is similar to the other two species described herein in that the red coloration in the spinous dorsal fin is restricted to the posterior three to five interradial membranes, and there is an incomplete band of black blotches that extends from the first to the sixth or seventh interradial membrane. Both the spinous and the soft dorsal fins of *E. lachneri* are moderately elevated, in comparison to other members of the *colorosum* subgroup.

DESCRIPTION: *Etheostoma lachneri* reaches a maximum of 47 mm SL (females) to 52 mm SL (males). Frequency distributions of scale and fin-ray counts are presented in Tables 1-5. Number of vertebrae, branchiostegal rays, gill rakers, and preoperculomandibular pores are given in Tables 6-7. The lateral line is usually complete with (39 –) 41 – 49 (– 51) scales, but occasionally the last scale is unpored. Transverse scales number 11 (2 specimens), 12 (21), 13 (45), 14 (45), 15 (33), 16 (8), or 17 (1). Transverse scales from origin of second dorsal fin to anal fin (an alternative count, see Bailey and Etnier 1988: 30) number 10 (1), 11 (31), 12 (19), 13 (7), mean of 58 counts, 11.5. Caudal peduncle scale rows number 14 (1), 15 (23), 16 (35), 17 (97), 18 (37), 19 (18), or 20 (2). Dorsal fin has (9 –) 10 – 11 (– 12) spines and (10 –) 11 – 12 (– 13) soft rays. Anal fin has 2 spines and (6 –) 7 – 8 (– 9), modally 7, soft rays. Pectoral fin has (13 –) 14 – 15 (– 16) rays. Vertebrae number 37 (11), 38 (66), 39 (13), or 40 (2); branchiostegal rays number 5—4 (1), 5—5 (201), 6—5 (4), 5—6 (3), or 6—6 (4); and gill rakers on first arch number 6 (7), 7 (32), 8 (90), 9 (44), 10 (8), or 11 (1). In general there is a weak clinal increase in the number of rakers from the northern or headwater tributaries southward to the southern or lower tributaries to the system. The sum of left and right preoperculomandibular pores is nearly constant at 18 (in 187 of 198 specimens); of the remaining 11, one has 16 pores, eight have 17 pores, and two have 19 pores. The opercle, cheek, and nape are nearly or completely covered with exposed scales. The nape is the most likely of the three areas to be incompletely covered with scales, and the cheek is the least likely to be incompletely covered. The breast is consistently scaleless.

In 10 specimens dissected, the vomer is toothless in three, has two slender teeth in three, three teeth in three, and a cluster of five or six in one, mean 2.05 teeth; the palatines are uniformly toothless.

Proportional measurements appear in Tables 8-9. Twelve of the 25 males were collected at the type locality during March and May. The remainder of the specimens came from six additional sites during March, April, and May. The ten females came from seven different sites including the type locality. Three specimens from the type locality were collected during March and the specimens from the six other sites were collected during March, May, and August.

Colors of live and freshly preserved nuptial specimens, collected in March and April, are described from Wolf Creek (type locality), tributary to Little Souwilpa Creek of the Tombigbee River system (Figure 7). Nuptial males at peak coloration have four to six, slightly oblique, dark green bars on the side of body and caudal peduncle. The posterior bar occurs near the middle of the caudal peduncle. Its broad base on the ventral part of the peduncle is usually continuous posteriorly with the dark green or turquoise on lower procurrent edge of caudal fin. Its dorsal extension on the side of peduncle narrows in width to form a more or less triangular bar. Occasionally nuptial males have this posterior bar connected to lower edge of a dorsal saddle blotch and rarely this posterior, triangular bar is branched to form two dorsal projections. The penultimate bar has a narrower base than the ultimate bar and extends from the anterior ventral part of caudal peduncle dorsad to the dorsal saddle blotch at the posterior insertion of second dorsal fin. The next bar anteriorly lies between the middle of the base of the anal fin and dorsal saddle blotch slightly anterior to the middle of the second dorsal fin base. The next bar anteriorly extends from the anterior base of anal fin dorsad to dorsal saddle blotch at posterior base of spinous dorsal fin. Frequently this bar does not extend to dorsal saddle blotch but instead only about half way between lateral line and dorsum, whereas other nuptial males (Figure 2) have a partial bar that extends ventrad from dorsal saddle blotch to slightly below lateral line and not all the way to the base of anal fin. Occasionally, large males have one or two more bars anterior to the ones described above but these invariably are incomplete, extending from dorsal saddle blotches ventrad to lateral line area or more or less centered vertically across the lateral line. Prenuptial males from February and early March usually have the triangular, ultimate bar well developed but the other bars are only partially developed. The interspaces between the green bars of the nuptial males are bright orange. This orange extends over entire ventral-lateral area anterior to the anal fin insertion. The coloration of the dorsal-lateral area of body and caudal peduncle varies considerably. Nuptial males have a row of orange to red-orange blotches just above the lateral line although more frequently this coloration is in a loose network pattern rather than discrete blotches. In addition there are scattered flecks of orange or red-orange on the remainder of the dorsal-lateral area. Other nuptial males have a reduced number of orange flecks and blotches. The dorsal saddle blotches (typically eight) and the top of head are dark brown with an overlay of green. There is a dark preorbital bar, a suborbital bar, and several post-orbital dark brown blotches. The snout, lips, gill membranes, isthmus, breast, as well as lower margins of cheek and opercle, are green or turquoise.

The pectoral fins are clear in the upper two-thirds and light green or olive on the lower third. The pelvics and all the median fins have some turquoise color. The pelvic fins except for the tips of the spines and soft rays are deep turquoise. The tips of rays are milky white. The anal fin is deep turquoise except for a pale "window" in the posterior central area. The caudal fin typically has bright turquoise procurrent marginal areas that are continuous with a broad

distal band of turquoise. The central basal area of the caudal fin is pale turquoise or nearly clear. There are two orange blotches, one above and one below the dark brown basi-caudal spot. The lower orange blotch is smaller and less distinct than the upper. Both the spinous and soft dorsal fins have turquoise margins and that on the soft dorsal fin is broader. Occasionally the turquoise will extend over the distal half of the anterior part of the spinous dorsal fin. The complete or nearly complete band of red blotches in the second dorsal fin and the incomplete, posteriorly located, red band in the first dorsal fin are similar to those described for *E. raneyi*. The cream and yellow color around the red blotches in both dorsal fins and the short band of black blotches in the first dorsal also are similar in position, as described for *E. raneyi*.

Nuptial females have little or no chromatic coloration. Small nuptial females lack chromatic coloration or have slight development of basi-caudal orange blotches. Some large females have basi-caudal orange blotches plus greenish lower procurrent margin of caudal fin and ventral posterior part of caudal peduncle; a light green wash on chin, gill membranes, and breast; light green along base of anal fin; and one or two small red blotches in the posterior membranes of the spinous dorsal fin.

DISTRIBUTION: *Etheostoma lachneri* is confined to the Tombigbee River system, from slightly above the Fall Line in several headwater tributaries to the lower part of the system in Mobile Cnty., Alabama (Figures 7, 9; Mettee et al., 1987: map, p. 173; Mettee et al., 1989a: map, p. 188; Boschung, 1989: map 107, p. 93; Mettee et al., 1989b: map, p. 152). Most of the records in the upper Tombigbee River system are in tributaries draining into the river from the east. The reason for the abrupt demarkation of the western distribution is undoubtedly correlated with the fact that the Tombigbee River is the common border for the western edge of the Fall Line Hills physiographic district and the eastern border of the Black Belt physiographic district (Mettee et al., 1989a: 18, Figure 7). Moreover, each physiographic district has a distinct geological base.

HABITAT AND BIOLOGY: *Etheostoma lachneri* occurs in a variety of habitats: small streams with a mixture of sand and gravel substrate; rubble-strewn areas at road crossings; and mixtures of sand, gravel, and hard clay or bedrock bottoms. The type locality, Wolf Creek, tributary to Little Souwilpa Creek, is a small stream 15 to 20 feet in width with sections of bedrock and sand bars upstream of Hwy. 17. There are some deep potholes in the bedrock sections. Downstream of Hwy. 17 the stream cascades down numerous ledges of bedrock. Wolf Creek enters Little Souwilpa Creek at the lower end of an extensive cascade on the Little Souwilpa, and has an overhanging canopy of shrubs and trees except at the highway crossing.

Based on recent observations, prenuptial conditions were evident in February and spawning occurs from early March to late April in the more southerly areas and perhaps into late May in the more northerly areas. The sex ratio is skewed toward more females in spawning aggregations. Based on nine collections of topotypes taken during February, March, and April, the 289 specimens include 124 (42.9%) males and 165 (57.1%) females. The 124 males range from 27.0 to 48.6 mm in SL with a mean of 37.9 mm; the 165 females range from 26.1 to 43.7 mm, mean 35.6 mm.

The species associates of *Etheostoma lachneri* at Wolf Creek (type locality), are as follows: *Erimyzon oblongus, Hypentelium etowanum, Moxostoma erythrurum, Moxostoma poecilurum, Campostoma* sp., *Cyprinella callistia, C. venusta, Luxilus*

chrysocephalus, Lythrurus bellus, Nocomis leptocephalus, Notropis ammophilus, N. baileyi, N. buccatus, Pimephales notatus, Semotilus atromaculatus, Ameiurus natalis, Noturus gyrinus, N. leptacanthus, N. nocturnus, Fundulus olivaceus, Lepomis cyanellus, L. macrochirus, L. megalotis, Etheostoma rupestre, E. stigmaeum, E. whipplei, and *Percina nigrofasciata.*

VARIATION: The number of gill rakers, in general, varies from low in the upstream tributaries to higher in the downstream tributaries to the Tombigbee River. However, the lowermost tributary sampled showed a reverse trend.

ETYMOLOGY: The name, *Etheostoma lachneri*, is in recognition of Ernest A. Lachner, a few of whose early publications were concerned with detailed studies of the biology of darters. Too, we recognize Dr. Lachner's exhaustive studies of the systematics, zoogeography, and biology of the genus *Nocomis*, but perhaps of equal importance to some of us (R. D. S.) was his seemingly untiring, unselfish expenditure of time and energy to help young ichthyologists during their formative professional years while he was Curator of Fishes at the United States National Museum.

Etheostoma ramseyi Suttkus and Bailey, new species
Alabama Darter
Figures 3, 7, 8, and 9

Etheostoma simoterum. Gilbert, 1891: 155 (misidentification, "abundant in Alabama basin, and varying more or less from the typical form").

Etheostoma (*Ulocentra*) sp. Smith-Vaniz, 1968: 136 (in part, reports from Cahaba and Alabama r. systems). Jenkins, 1976: 644 (in part, distribution). Kuehne and Barbour, 1983: 97 ("Gulfcoast Snubnose Darter," in part, characterized, range map, in part). Pierson et al., 1989: 1, 14, 15, 17, 26-50, 171 (habitat, map of localities in Cahaba River system, Alabama). Boschung, 1992: 122 (in part, "orangestripe darter," a complex of species).

Etheostoma sp. Suttkus and Boschung, 1990: 60 (Chilatchee Creek, Alabama record, species associates). Page and Burr, 1991: 302, map 346 (in part, characterized, range map in part).

HOLOTYPE: Adult male, TU 162574, 49.2 mm standard length, Beaver Creek, tributary to Alabama River at Wilcox Cnty. Road 27, 0.8 mile west of Sunny South (T11N, R4E, Sec 3), Wilcox Cnty., Alabama, 31 March 1992, R. D. Suttkus.

PARATOPOTYPES: TU 162575 (138, 29 – 46), collected with holotype, distributed as follows: TU 162575 (126), CU 73783 (2), UMMZ 222915 (4), USNM 325770 (2), UT 91.4345 (4); TU 158276 (48, 30 – 49), 26 May 1990, distributed as follows: TU 158276 (42), ANSP 170041 (2), UAIC 10683.01 (2), UF 100287 (2); TU 166073 (20, 33 – 49), 22 November 1992; TU 166090 (15, 34 – 47), 23 November 1992; TU 166398 (33, 32 – 45), 7 February 1993; TU 166625 (19, 35 – 47), 27 March 1993; TU 166737 (20, 36 – 49), 17 April 1993; TU 167014 (29, 35 – 46), 17 May 1993.

OTHER PARATYPES: Alabama. Clarke Cnty.: TU 158262 (7, 38 – 42), Beaver Creek at dirt road, 0.8 mi. SE Atkinson (T11N, R4E, Sec 3), 26 May 1990. Wilcox Cnty.: UAIC 2040 (20, 18 – 47) Beaver Creek, 2 mi. SE Pine Hill at Cnty. Rd. (T12N, R5S, Sec 33), 30 May 1966; TU 44496 (26, 27 – 38), Turkey Creek at Hwy. 5, 1.0 mi. S Kimbrough (T12N, R5E, Sec 10), 18 March 1967; TU 154710 (12, 32 – 43), 9 May 1989. Marengo Cnty.: TU 32429 (142, 14 – 44), Dry Creek, tributary to Turkey Creek at Hwy. 10, 1.0 mi. E Vineland or

4.7 mi. W Hwy. 5 at Pine Hill (T12N, R4E, Sec 11), 28 May 1964; TU 151854 (33, 28 – 42), 17 April 1988; TU 157582 (35, 29 – 46), 22 March 1990; TU 157751 (29, 30 – 44), 11 April 1990, distributed as follows: TU 157751 (19), UMMZ 222916 (10); TU 161920 (22, 30 – 45), 24 November 1991; TU 162361 (11, 30 – 40), 2 March 1992; TU 162615 (15, 34 – 45), 31 March 1992; and TU 166409 (35, 34 – 49), 7 February 1993; TU 158313 (2, 40 – 46), Dry Creek at Hwy. 25, 0.9 mi. S Vineland (T12N, R4E, Sec 10), 26 May 1990; TU 158293 (26, 32 – 46), Little Creek, tributary to Dry Creek at Hwy. 25, 0.3 mi. N Vineland (T12N, R4E, Sec 3), 26 May 1990; TU 161862 (13, 30 – 41), 24 November 1991; and TU 162377 (8, 33 – 39), 2 March 1992; TU 161881 (6, 33 – 38), Baptizing Creek, tributary to Turkey Creek at Hwy. 25, 1.4 mi. N Vineland (T13N, R4E, Sec 35), 24 November 1991; and TU 162601 (1, 34), 31 March 1992; TU 161904 (5, 32 – 40), Turkey Creek at Hwy. 25, 3.5 mi. N Vineland (T13N, R4E, Sec 23), 24 November 1991.

ADDITIONAL MATERIAL EXAMINED, NOT DESIGNATED AS TYPES: **Alabama River system. Alabama.** BALDWIN-MONROE CNTY.: TU 32551 (1), Little River at Hwy. 59 at Chrysler, 13.5 mi. W Uriah (T4N, R4E, Sec 19), 30 May 1964, TU 44399 (1), 17 March 1967, and TU 44419 (1), 18 March 1967. ESCAMBIA-MONROE CNTY.: TU 99950 (29), Little River at Escambia Cnty. Rd. 1, 7.9 mi. NW McCullough (T3N, R5E, Sec 7), 20 October 1976; TU 153964 (10), Little River at Hwy. 21, 4.1 mi. S Uriah (T3N, R6E, Sec 5), 4 November 1988, TU 154479 (4), 21 March 1989, and TU 162548 (1), 30 March 1992. CLARKE CNTY.: TU 34012 (4), Sand Hill Creek 1.1 mi. W Choctaw Bluff (T5N, R3E, Sec 27), 1 July 1964, and TU 41447 (8), 30 June 1966; TU 32500 (6), Big Reedy Creek at Clarke Cnty. Rd. 19, 1.5 mi. N Choctaw Bluff (T5N, R3E, Sec 22), 28 May 1964; TU 125380 (3), 14 May 1982, TU 163242 (13), 11 May 1992, and TU 165506 (3), 30 August 1992; TU 165527 (1), Sizemore Creek at Clarke Cnty. Rd. 2 (T5N, R4E, Sec 7), 30 August 1992; TU 137048 (12), Silver Creek, 5 mi. W Chance or 3.5 mi. E Scyrene (T9N, R5E, Sec 17), 8 August 1984, and TU 152495 (8), 26 May 1988. MONROE CNTY.: TU 43254 (3), Wallers Creek, 5.7 mi. E Eureka Landing on Alabama River (T5N, R4E, Sec 33), 5 February 1967; TU 153937 (1), Randons Creek at Monroe Cnty. Rd. 23, 5 mi. NW Frisco City (T6N, R6E, Sec 15), 4 November 1988; UAIC 2357 (27), Randons Creek, approximately 2 mi. S US Hwy. 84, 25 September 1966. WILCOX CNTY.: TU 32454 (24), Bear Creek at Wilcox Cnty. Rd. 1, 3.1 mi. NW Lower Peach Tree (T11N, R5E, Sec 33), 28 May 1964, TU 60866 (32), 16 December 1969, TU 87039 (11), 21 March 1974, and TU 107599 (2), 26 March 1976; TU 47391 (1), Alabama River at Tait Bar, River Mile 122.4 (T11N, R6E, Sec 24), 7 August 1967; TU 3420 (2), Pursley Creek at Hwy. 11, 3.4 mi. SW Camden (T11N, R7E, Sec 2), 3 June 1951; TU 3067 (2), tributary to Pursley Creek at Hwy. 10, 1.8 mi. E Camden (T12N, R8E, Sec 27), 3 June 1951; TU 47379 (1), Alabama River at Reeves Bar, River Mile 128.5 (T11N, R7E, Sec 5), 7 August 1967; TU 47769 (2), Alabama River at Lower Canton Bar, River Mile 156.7 (T13N, R7E, Sec 23), 18 August 1967; TU 2575 (19), Turkey Creek, tributary to Pine Barren Creek at Hwy. 10, 0.8 mi. W Awin (T10N, R11E, Sec 16), 2 June 1951, and TU 32606 (66), 30 May 1964; TU 60890 (154), Chilatchee Creek at Hwy. 5, 0.3 mi. N Alberta (T15N, R7E, Sec 30), 18 December 1969, TU 121394 (14), 15 May 1981, TU 125405 (44), 15 May 1982, TU 140941 (23), 24 May 1985, TU 145528 (4), 20 May 1986, TU 151640 (21), 9 April 1988, TU 153093 (12), 2 August 1988, TU 153195 (26), 3 August 1988, TU 154403 (17), 3 February 1989, TU 154740 (33), 9 May 1989, TU 157470 (22), 1 March 1990, TU 157591 (13), 22 March 1990, TU 162585 (7), 31 March 1992, TU 162984 (24), 27 April 1992, TU 163218 (17), 11 May 1992, and TU 166792 (20), 18 April 1993. DALLAS CNTY.: TU 159006 (2), Tatum Creek, tributary to Bogue Chitto Creek at Dallas Cnty. Rd. 11 (T16N, R8E, Sec 28), 18 August 1990; TU 158962 (3), Dry Creek, tributary to Bogue Chitto Creek at Dallas Cnty. Rd. 3 (T16N, R8E, Sec 17), 18 August 1990; TU 158982 (2), Bogue Chitto Creek at Dallas Cnty. Rd. 182 (T16N, R7E, Sec 12), 18 August 1990; UAIC 2402 (14), Soapstone Creek at US Hwy. 80, 7 mi. E Selma, 7 December 1966; TU 32648 (30), White Oak Creek at Hwy. 41, 13.3 mi. NE Camden (T13N, R10E, Sec 8), 30 May 1964, TU 35376 (61), 29 June 1964, TU 157494 (9), 1 March 1990, TU 158887 (25), 17 August 1990, and TU 162970 (53), 26 April 1992; TU 158926 (5), Musk Creek at Hwy. 41, 2.9 mi. S Sardis (T15N, R11E, Sec 29), 17 August 1990; TU 35171 (6), Pine Flat Creek (Six Mile Creek) at Hwy. 41, 6 mi. S Selma (T16N, R11E, Sec 32), 27 June 1964, and TU 158945 (1), 17 August 1990. AUTAUGA CNTY.: UAIC 2043 (13), Swift Creek, Autaugaville on Hwy. 14 (T17N, R14E, Sec 22), 31 May 1966; UMMZ 146523 (1), Beaver Creek, 5 mi. W Autaugaville (T17N, R13E, Sec 14), 13 June 1942, and UMMZ 146547 (1), 20 December 1942; UMMZ 146539 (6), tributary to Beaver Creek, 5 mi. W Autaugaville (T17N, R13E), 20 March

1942; UMMZ 124134 (1), Autaugaville (T17N, R14E); UAIC 2311 (19), Autauga Creek between Oak Grove and White City (T19N, R15E, Sec 16), 1 July 1966. Chilton Cnty.: TU 157605 (15), Bear Creek, tributary to Benson Creek at Chilton Cnty. Rd. 15, 4.8 mi. ENE Maplesville (T21N, R13E, Sec 16), 23 March 1990; TU 27347 (4), Mahan Creek, tributary to Little Cahaba River at Chilton Cnty. Rd. 3213, 0.7 mi. NW Jemison (T23N, R13E, Sec 15), 20 December 1961. Perry Cnty. UMMZ 212385 (3), Silver Creek, 1 mi. E Suttle at US Hwy. 43 (T18N, R9E, Sec 21), 6 February 1965; TU 32711 (39), Ellards Creek, tributary to Taylor Creek, tributary to Cahaba River at Hwy. 5, 10.6 mi. SW Brent or 1.3 mi. S Bibb Cnty. line (T21N, R8E, Sec 10), 31 May 1964, TU 151661 (30), 9 April 1988, TU 151809 (57), 16 April 1988, TU 162997 (28), 27 April 1992, TU 166615 (1), 26 March 1993, and TU 166783 (8), 18 April 1993. Bibb Cnty.: TU 15297 (1), Cahaba River, 2.2 mi. N Centreville (T23N, R9E, Sec 14), 17 May 1957, and TU 35085 (1) 26 June 1964; TU 151818 (68), Little Schultz Creek, 7.2 mi. N Centreville (T24N, R9E, Sec 24), 16 April 1988, TU 163006 (14), 27 April 1992, and TU 166774 (11), 18 April 1993; TU 19414 (1), Cahaba River at Hwy. 27, 8.5 mi. N Centreville (T24N, R10E, Sec 33), 8 September 1958; TU 106753 (9), Coffee Creek, tributary to Cahaba River at Bibb Cnty. Rd. 24 at Blocton (T22S, R6W, Sec 24), 14 April 1978; TU 25994 (14), Six Mile Creek, tributary to Little Cahaba River at Hwy. 25, about 10 mi. NE Centreville (T23N, R11E, Sec 6), 17 April 1962; TU 152178 (5), Cooperas Creek, tributary to Six Mile Creek (T23N, R11E, Sec 16), 12 May 1988; TU 152158 (24), Six Mile Creek (T23N, R11E, Sec 15), 12 May 1988; TU 106776 (2), Little Cahaba River at Bulldog Bend at Bibb Cnty. Rd. 65 (T24N, R11E, Sec 19), 14 April 1978. Shelby Cnty.: TU 27376 (7), tributary to Shoal Creek, tributary to Little Cahaba River, 2 mi. NNW Montevallo (T22S, R3W, Sec 19), 21 December 1961; UMMZ 198756 (3), Big Cahawba River, Helena (T20S, R3W, Sec 15), 20 May 1889; AUM 9571 (1), Little Cahaba River at Coal Branch, 2.0 airmi. SE Cahaba Heights (T18S, R1W, Sec 19), 30 October 1971. Jefferson Cnty.: UMMZ 168646 (38), Little Cahaba River at US Hwy. 78 at Leeds (T17S, R1E, Sec 21), 3 September 1954, and UMMZ 177738 (56), 22 May 1956. St. Clair Cnty.: TU 166768 (6), Little Cahaba River at Oliver Rd. in Leeds (T17S, R1E, Sec 15), 18 April 1993.

Diagnosis: *Etheostoma ramseyi* is a member of subgenus *Ulocentra* as diagnosed by Bouchard (1977) and Bailey and Etnier (1988). *Etheostoma ramseyi* lacks a premaxillary frenum and the head of the vomer usually has one or a few slender teeth and therefore is typical of members of the *Etheostoma duryi* species group of Bailey and Etnier (1988). *Etheostoma ramseyi*, like *E. lachneri* and *E. raneyi*, lacks a red ocellus in the first interradial membrane of the spinous dorsal fin. The unique features of nuptial male *E. ramseyi* are the size and disposition of the dark lateral blotches along the lateral line, the presence of a series of orange to russet blotches dorsad of the lateral blotches, the interconnection of lateral blotches with respective dorsal saddle blotches, and the continuous orange coloration of the ventral lateral part of the body and caudal peduncle with dorsal extensions between posterior lateral blotches on caudal peduncle. The lateral blotches are of moderate size and are ovoid to rounded quadrate in shape.

Description: *Etheostoma ramseyi* reaches a maximum of 45 mm SL (females) to 51 mm SL (males). Sexual dimorphism and apparent sexual maturity occur at the end of the first year at a minimum of 29 mm SL for both females and males. Frequency distributions of scale and fin-ray counts are presented in Tables 1-5. Number of vertebrae, branchiostegal rays, gill rakers, and preoperculomandibular pores are given in Tables 6-7. The lateral line is usually complete with (40 –) 42 – 49 (– 53) scales, occasionally the last one or two scales are unpored. Transverse scales number 12 (11 specimens), 13 (48), 14 (44), 15 (35), 16 (8), or 17 (4). Transverse scales from origin of second dorsal fin to anal fin (an alternative count, see Bailey and Etnier 1988: 30) number 11 (10), 12 (33), 13 (17), 14 (2), mean of 62 counts, 12.2. Caudal peduncle scale rows number 14 (2), 15 (20), 16 (45), 17 (85), 18 (45), 19 (12), or 20 (3). Dorsal fin has (8 –) 10 – 11 (– 12) spines and (10 –) 11 – 12 (– 13) soft rays. Anal fin has 2 spines

and 6 – 7 (– 8), modally 7, soft rays. Pectoral fin has 13 – 15 rays. Vertebrae number 37 (23), 38 (88), or 39 (19); branchiostegal rays number 4—4 (1), 5—3 (1), 5—4 (3), 5—5 (181), 5—6 (2), or 6—6 (1), and gill rakers on first arch number 6 (6), 7 (20), 8 (43), 9 (78), 10 (36), or 11 (3). In general there is a decrease in the number of gill rakers from the northern or headwater tributaries southward to the southern or lower tributaries to the Alabama River system. The sum of left and right preoperculomandibular pores is nearly constant at 18 (171 of 179 specimens), of the remainder, one has 16 pores, seven have 17 pores. The opercle, cheek, nape, and prepectoral area typically are covered with exposed scales. Occasionally the opercle, cheek, or nape has slightly reduced scale coverage and in a few individuals some of the cheek scales are embedded. The belly is consistently covered with exposed scales whereas the breast is consistently scaleless.

In 10 specimens examined for dentition, the vomer lacks teeth in one, the head of the vomer bears a single slender tooth in three, there are two teeth in two, three teeth in three, and four teeth in one, mean 2.0; all 10 lack palatine teeth.

Proportional measurements appear in Tables 8-9. The 25 males represent specimens from five different months: March (9 specimens), May (10), June (1), July (2), and December (3). The ten females represent specimens from two months: March (6) and May (4).

Colors of live and freshly preserved specimens, collected in February, March, and May, are described from Beaver Creek, the type locality. We preface our descriptive remarks by saying that perhaps *E. ramseyi* is the most variable of the three new species in its nuptial coloration, especially when considering different sub-populations. Nuptial males have orange coloration on nearly the entire lower side of body and caudal peduncle. Except for extreme anterior part of body the orange extends dorsad to the ventral margin of lateral brown blotches (typically eight) and up to lateral line between lateral blotches. The orange from the venter fuses or merges with orange blotches above the lateral line in the last two interspaces on the caudal peduncle. The orange on the last interspace is continuous with two elongate orange blotches at base of caudal fin. The penultimate, lateral, brown blotch, plus the next four anteriorly, have an overlay of green that extends diagonally down from a respective dorsal saddle blotch (Figure 3). Occasionally the green overlay extends downward over the penultimate lateral brown blotch to the midventral line. A similar extension of the next anterior lateral blotch is rare. The lateral brown blotches are moderate in size and are centered along the lateral line. There is a series of distinct oblong blotches on the dorsal lateral area just above the lateral line. These occur between the diagonal green bars that extend from dorsal saddle blotches to the lateral brown blotches along the lateral line. This series of blotches above the lateral line grades from bright red or red-orange posteriorly to russet anteriorly. As mentioned above, the last two red or red-orange blotches merge with the orange of the ventral lateral area. The red or red-orange blotches are brighter in large prenuptial males and in small nuptial males than in large nuptial males. Moreover the posterior two blotches on the caudal peduncle in prenuptial males are separate from the ventral lateral orange on the caudal peduncle. Thus the ventral lateral coloration becomes more extensive and the blotches in the series above the lateral line become darker with the approach of the height of nuptial condition. Nuptial males have a variable amount of red or orange pigment high on the dorsal lateral area on the otherwise pale areas between the dorsal saddle

blotches. Additional information regarding coloration is given in the section on variation. The dorsal saddle blotches (typically eight) are dark brown with an overlay of green. The breast, gill membranes, cheek, lower part of opercle, and side and anterior tip of snout are light to dark turquoise. There are dark brown preorbital and suborbital bars, as well as several brown blotches along upper margin of the opercle. The turquoise, red, black, yellow, and cream pigmentation on both the spinous and soft dorsal fins of the nuptial male *E. ramseyi* is similar to that described for *E. raneyi* and *E. lachneri*. The caudal fin of *E. ramseyi* nuptial male has turquoise edging on procurrent margins and light turquoise on outer part of both upper and lower lobes. The two elongate orange blotches at base of the caudal fin are prominent and are continuous with orange on caudal peduncle. The anal fin is a uniform turquoise and seldom has a pale "window" as is common in nuptial male *E. lachneri*. The pelvic fins are turquoise with milky white tips on the anterior rays. The pectoral fins of nuptial males from the type locality lack turquoise but do have some yellowish pigment along the lower rays.

Nuptial females have some bright coloration although greatly reduced in coverage compared to that of the nuptial male. Large females have brighter coloration than small females and the smallest sexually mature females may completely lack bright colors. A sample taken from White Oak Creek, Dallas Cnty., Alabama on 26 April 1992 contained 39 females. These specimens were examined in detail for presence of red or orange coloration, and were tallied under six categories. Thirty eight of the 39 specimens had several blotches of orange in the lateral series just above lateral line; 37 of 39 had the two basicaudal orange blotches; 34 had one or more red spots in spinous dorsal fin; 24 had some orange on lower side of body; 22 had some red spots in second dorsal fin; and only six of the 39 females had some flecks or small blotches of red or orange high on the upper side between the dorsal saddle blotches.

DISTRIBUTION: *Etheostoma ramseyi* is distributed mostly below the Fall Line in the Alabama River system but is relatively common in headwater tributaries to the Cahaba River above the Fall Line (Figures 7, 9). No other species of subgenus *Ulocentra* occurs within the range of *E. ramseyi*. We do not believe the absence of *E. ramseyi* in the north-westerly flowing tributaries to the upper Alabama River and the lower Tallapoosa River below the Fall Line is an artifact due to lack of collecting effort. The reason for the absence in this area is not fully understood, but perhaps it is because this area represents the eastern extension of the Black Belt district and there is limited suitable habitat (Harper, 1943).

HABITAT AND BIOLOGY: Beaver Creek at the type locality has a diversity of habitats. In general there is an alternation of pools and riffles, raceways or cascades. Pools vary from one to three feet in depth during low flow and have sand or bedrock substrates. The substrate elsewhere is gravel, sand, rock, clay rubble, or bedrock. There are patches of *Justicia* on some of the small gravel bars. The stream is 15 to 20 feet in width at low flow and is bordered by steep banks, especially at the road crossing. The banks are wooded and thus the stream is shaded during the summer months.

Based on recent observations, spawning occurs from early March to late April or early May at the type locality, however the spawning period may extend earlier into late February at some more southern localities or later into May farther north. Air temperature at any particular time has little correlation with reproductive activities. However, water temperature is directly related to nuptial

development and spawning activities. Although water temperatures are related to air temperature, the proximity of spring flow, nature of stream substrate, and the vegetation coverage in the watershed, particularly in the riparian strip, enhance or decrease the impact on stream temperature. Within the same 24 hour period (17-18 April 1993) water temperature of Little Cahaba River at Leeds, St. Clair Cnty. (above the Fall Line) was 15° C, Little Schultz Creek, 7.2 mi. N Centreville, Bibb Cnty. was 17° C, Ellards Creek, 10.6 mi. S Centreville, Perry Cnty., was 16° C, Chilatchee Creek, 0.3 mi. N Alberta, Wilcox Cnty. was 20° C, and at Beaver Creek, the type and most southern locality, was 14° C. Most spawning is completed before the water temperature reaches 20° C. Short periods of 20° C may not terminate spawning activities but when temperatures of 20° C or higher are sustained then termination of spawning is almost sure to occur.

The sex ratio is skewed toward more females in spawning aggregations. Based on five collections of topotypes taken during February to May, the 259 specimens include 91 (35.1%) males and 168 (64.9%) females. The males range from 29.1 to 49.2 mm SL, mean 39.8 mm; the females from 28.9 to 44.2 mm SL, mean 37.4 mm.

The species associates of *E. ramseyi* at the type locality are as follows: *Ichthyomyzon gagei, Moxostoma erythrurum, M. poecilurum, Campostoma* sp., *Hybognathus nuchalis, Luxilus chrysocephalus, Lythrurus bellus, Nocomis leptocephalus, Notropis ammophilus, N. baileyi, N. buccatus, Pimephales notatus, Semotilus atromaculatus, Ictalurus punctatus, Noturus funebris, N. leptacanthus, Fundulus olivaceus, Gambusia affinis, Lepomis cyanellus, L. macrochirus, L. megalotis, Etheostoma nigrum, E. whipplei, Percina maculata*, and *P. nigrofasciata.*

VARIATION: Number of gill rakers is the only meristic character that shows some geographic variation. We did not detect any geographical trends in the morphometrics that are presented in Tables 8 and 9. Although not fully investigated by us, we believe that nuptial males in the upper part of the Cahaba River system display more and larger blotches of red on the dorsal lateral area of body, between the dark brown dorsal saddle blotches, than the lower Cahaba and Alabama river populations. Females display a similar trend. Also we observed that, in some samples, both males and females were darker than in other samples, however, we believe this to be a direct correlation with substrate color and perhaps water clarity.

ETYMOLOGY: We take pleasure in naming this darter for John S. Ramsey, who contributed to our knowledge of the systematics, zoogeography, and biology of the darters and other fishes in the southeastern United States. Dr. Ramsey generously contributed his field notes and preliminary analyses.

COMPARISONS

The typical nuptial coloration of males of *Etheostoma raneyi, E. lachneri*, and *E. ramseyi* is illustrated in Figures 1-3 respectively. The lateral stripe of *E. raneyi* is composed of two sets of blotches. One set of oblong or elongate blotches aligned along the lateral line is more or less interposed by a second set of oval or quadrate blotches. Although blotches in both of these series are variable in shape and density of pigmentation, their ventral borders form a continuous rather smooth margin. The entire lower side below this margin is orange to red-orange (Figure 1). *Etheostoma ramseyi* has a single series of blotches along the

lateral line and the orange or red-orange of the lower side extends dorsad between the blotches, that is, covering the interspaces and thus producing a scalloped pattern along the lateral blotches. The second set of blotches occurs well above the lateral line. Occasionally the penultimate blotch along the lateral line is continuous with green or turquoise coloration on the ventral part of the caudal peduncle (Figure 3). *Etheostoma lachneri* is unique in the presence of two to five complete, slightly oblique green bars on the posterior half of the body. Those males with fewer than four complete bars usually have one or more incomplete bars. The interspaces between the bars and the anterior ventral lateral area of body are deep orange. The orange coloration above the lateral line is not in the form of compact blotches but instead is an irregular network of color (Figure 2).

The illustration of the male *E. raney*i (Yazoo darter) in Deacon et al. (1979: 42) does not show the typical bright nuptial coloration. The color illustration of the male *E. raneyi* (Yazoo darter) in Page and Burr (1991: plate 43) is an accurate depiction of the lateral blotches and the ventral lateral coloration, however, the spinous dorsal fin does not have a complete band of red blotches across the entire fin as shown in their illustration. Also there is an incomplete band of black blotches (not shown in their illustration) along the proximal part of anterior membranes of the spinous dorsal fin.

We are somewhat perplexed with the illustration of the "Coastal Plain darter" (Page, 1983: plate 16G). The locality data given are Minter Creek, Greene Cnty., Alabama and date of collection 17 April 1977. Our first collection of 13 specimens (4 males) from Minter(s) Creek, Greene Cnty., Alabama was obtained on 26 March 1993. All four males had the green-barred pattern as shown in Figure 2. Our second collection (8 specimens) from the same site was taken on 17 April 1993 and the three males also had the barred pattern, although none was as developed as illustrated in Figure 2. The pale "window" in the anal fin, the noticeably elevated spinous dorsal fin, and the network of orange coloration above the lateral line lead us to confirm the Page (1983: plate 16G) illustration as *Etheostoma lachneri*. We suspect that the photo was taken quite a while after capture and as a result much of the green and turquoise color had already faded. We are unaware of any published illustrations of *Etheostoma ramseyi*.

A review of the eight scale, fin-ray, and vertebral counts (Tables 1-6) reveals that *Etheostoma raneyi, E. lachneri*, and *E. ramseyi* are quite similar in these meristics. The number of gill rakers on first arch in *E. raneyi* ranged from 8 to 10, mean, 9.0; the number in both *E. lachneri* and *E. ramseyi* ranged from 6 to 11, means, 8.1 and 8.7 respectively (Table 7).

Thirteen of nineteen proportional measurements on 25 adult males and 10 adult females of each of the three species (Tables 8-9) show differences that we interpret as independent species variation and not a clinal geographic pattern of a single species. For males, the westernmost species, *E. raneyi*, is intermediate between *E. lachneri* and *E. ramseyi* in eight of thirteen proportions. *Etheostoma raneyi* has the longest head, anal soft ray, pelvic fins, and greatest trans-pelvic width but the shortest soft dorsal fin. *Etheostoma lachneri*, which is intermediate geographically, has the longest or greatest measurement for eight of the proportions (longest dorsal spine, soft dorsal fin, dorsal soft ray, anal fin, first anal spine, caudal fin, pectoral fin, and greatest body depth); is intermediate in length of head and length of longest anal soft ray; is equal to *E. ramseyi* in length of pelvic fins; and has the shortest caudal peduncle, and least trans-pelvic width. *Etheostoma ramseyi* has the shortest or least average measurement for nine of the

thirteen proportions (longest dorsal spine, dorsal soft ray, anal fin, first anal spine, anal soft ray, caudal fin, pectoral fin, head length, and the least body depth measurement); intermediate in length of soft dorsal fin and trans-pelvic width, equal to *E. lachneri* in length of pelvic fins; and has the longest caudal peduncle.

For females (Table 9), *Etheostoma raneyi* has the longest or greatest measurement for 11 of the thirteen proportions (longest head, dorsal spine, dorsal soft ray, caudal peduncle, anal fin, first anal spine, and soft ray, caudal fin, pelvic fins, greatest body depth, and trans-pelvic width) but intermediate pectoral fin length. *Etheostoma lachneri* (intermediate geographically), has the shortest or least measurement for 12 of the 13 proportions (recall that *E. lachneri* males have the longest or greatest measurements of the three species for eight of the 13 proportions). Females of all three species have nearly identical soft dorsal fin length measurements. *Etheostoma ramseyi* females have the longest pectoral fins.

Comparison of species in a five-member subgroup: We here propose that *Etheostoma raneyi, E. lachneri, E. ramseyi, E. colorosum*, and *E. tallapoosae* (Figures 1-5) form a subgroup of the *E. duryi* species group of Bailey and Etnier (1988). The combination of the absence of the red ocellus in the first membrane of the spinous dorsal fin, the incomplete band of red blotches in the spinous dorsal fin (primarily on posterior membranes only) and the incomplete band of black blotches in the spinous dorsal fin (on all anterior membranes but lacking on posterior few) unites these five species but at the same time distinguishes them from all other described species of the subgenus (*Ulocentra*). Separate principal components analyses (PCA) were performed on morphometric data for 25 males and 10 females of the three new species plus *E. tallapoosae* and *E. colorosum* to characterize overall shape relationships. The analyses were performed with Statistical Analysis System (SAS) software. Log-transformed data for 19 morphometric variables were first regressed on standard length and the residuals retained for PCA. This partial regression procedure effectively removed a strong size-related trend in the data evidenced by highly inter-correlated variables and a high degree of variability explained by the first principal component axis (PC1). After partialling out the effect of standard length, variables were largely uncorrelated and PC1 accounted for only 34% of the variability in the data for males and 24% of the variability for females.

Results of the PCAs are presented in Figure 8 as polygons representing projections of data for males and females of each of the five species in the space of the first two principal components. In both sets of plots, species are separated mainly along PC1 which relates primarily to fin dimensions (positive values representing long and elevated fins). There is considerable overlap among species, but overlap is greater among males than among females. The greatest separation among species is between *E. tallapoosae* and *E. colorosum*, with the latter tending to have the longer and more elevated fins. Also of interest is that *E. colorosum* is completely separate (both males and females) from *E. tallapoosae* and *E. ramseyi* in shape characteristics (Figure 8) although the latter two species are close geographical associates in an adjacent drainage system. The new species exhibit considerable overlap in shape characteristics with *E. ramseyi* being more similar to *E. tallapoosae*, and *E. lachneri* and *E. raneyi* being intermediate between the two extremes.

The five species of the subgroup are allopatric and no one of them is known to be sympatric with any other species of subgenus *Ulocentra* (Figure 9). Two (*E. raneyi* and *E. colorosum*) inhabit discrete drainage areas. The other three live in separate areas of the Mobile Basin; of these *E. lachneri* lives in the Coastal Plain

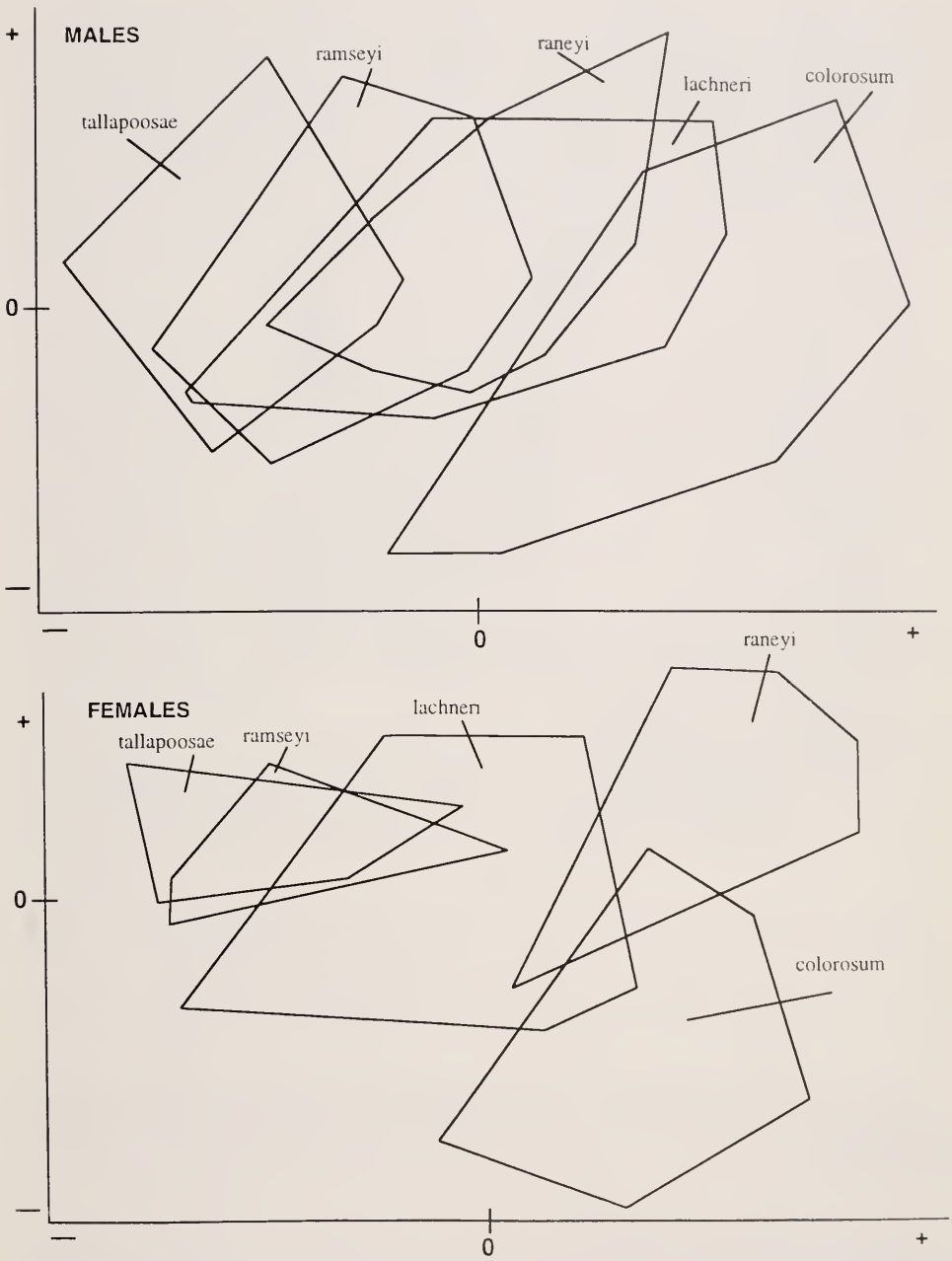


Figure 8. PCA polygons representing projections of morphometric data for *Etheostoma raneyi, E. lachneri, E. ramseyi, E. tallapoosae*, and *E. colorosum*.

to the Fall Line in the Tombigbee River system, *E. ramseyi* occurs in the Alabama River system largely below the Fall Line, but crosses that line in the Cahaba River system. *Etheostoma tallapoosae* inhabits the Tallapoosa River system above the Fall Line. Six additional species of subgenus *Ulocentra* (one yet unnamed) occur in the Mobile River system, all above the Fall Line.

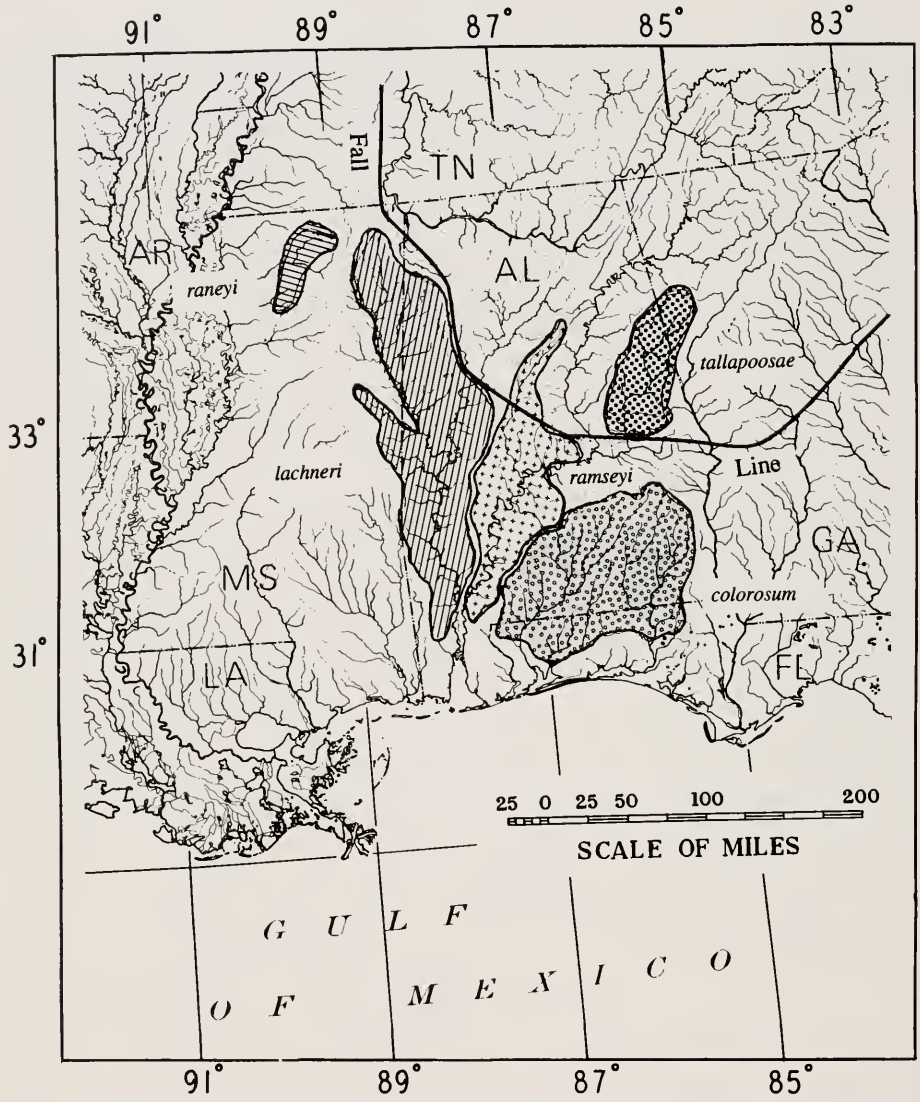


Figure 9. Distribution of five darters of *duryi* species group of *Etheostoma* subgenus *Ulocentra*: *E. raneyi*, *E. lachneri*, *E. ramseyi*, *E. colorosum*, and *E. tallapoosae* in Mississippi, Alabama, and parts of adjacent states.

Acknowledgments

Study materials and distributional records of the three new snubnose darters have been accumulating over the years, due to the efforts of many individuals including past students and faculty of Auburn University, Cornell University, Mississippi State University, Tulane University, University of Alabama, University of Michigan, University of New Orleans, and University of Tennessee. We extend our thanks to Glenn H. Clemmer (formerly at Mississippi State University) and John S. Ramsey (formerly at Auburn University) for the loan of materials under their care.

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Literature Cited

Bailey, R. M. and D. A. Etnier. 1988. Comments on the subgenera of darters (Percidae) with descriptions of two new species of *Etheostoma* (*Ulocentra*) from southeastern United States. Misc. Publ. Mus. Zool. Univ. Michigan 175: 1-48.

Boschung, H. T. 1987. Physical factors and the distribution and abundance of fishes in the upper Tombigbee River system of Alabama and Mississippi, with emphasis on the Tennessee-Tombigbee Waterway. *In* W. J. Matthews and D. C. Heins, eds. Community and Evolutionary Ecology of North American Stream Fishes (pp. 184-192). Univ. Oklahoma Press, Norman.

Boschung, H. T. 1989. Atlas of fishes of the upper Tombigbee River drainage, Alabama-Mississippi. Proc. Southeast. Fishes Council 19: 1-104.

Boschung, H. T. 1992. Catalog of freshwater and marine fishes of Alabama. Bull. Alabama Mus. Nat. Hist. No. 14 (266 pp.).

Bouchard, R. W. 1974. The subgenus *Ulocentra* (Percidae, Etheostomatini) in western Kentucky, western Tennessee and northern Mississippi. Assoc. Southeast. Biologists Bull. 21: 41 (abstract).

Bouchard, R. W. 1977. *Etheostoma etnieri*, a new percid fish from the Caney Fork (Cumberland) River system, Tennessee, with a redescription of the subgenus *Ulocentra*. Tulane Stud. Zool. Bot. 19: 105-130.

Clemmer, G. H., R. D. Suttkus, and J. S. Ramsey. 1975. A preliminary checklist of endangered and rare fishes of Mississippi. *In* Mississippi Game and Fish Comm. Preliminary list of rare and threatened vertebrates in Mississippi (pp. 6-11). Jackson, Mississippi.

Deacon, J. E., G. Kobetich, J. D. Williams, and S. Contreras. 1979. Fishes of North America endangered, threatened, or of special concern: 1979. Fisheries 4(2): 29-44.

Gilbert, C. H. 1891. Report on explorations made in Alabama during 1889 with notes on the fishes of the Tennessee, Alabama, and Escambia rivers. Bull. U. S. Fish Commission (1889) 9: 143-159.

Harper, R. M. 1943. Forests of Alabama. Geological Survey of Alabama Monograph 10 (230 pp.).

Hubbard, W. D. 1987. Distribution and diversity of fishes in the Noxubee River drainage, Mississippi. J. Mississippi Acad. Sci. 32: 19-29.

Hubbard, W. D., C. E. Tucker, and H. Boschung. 1991. Fishes of the Sucarnoochee River system, Alabama and Mississippi. Proc. Southeast. Fishes Council 24: 1-11.

Hubbs, C. L. and K. F. Lagler. 1958. Fishes of the Great Lakes region. Cranbrook Inst. Sci. Bull. 26 (213 pp.).

Jenkins, R. E. 1976. A list of the undescribed freshwater fish species of continental United States and Canada, with additions to the 1970 checklist. Copeia 1976: 642-644.

Knight, S. S. and C. M. Cooper. 1987. Fishes of Otoucalofa Creek, Mississippi prior to major channel modifications. J. Mississippi Acad. Sci. 32: 31-38.

Kuehne, R. A. and R. W. Barbour. 1983. The American Darters. Univ. Kentucky Press, Lexington (201 pp.).

Lowe, E. N. 1925. Geology and mineral resources of Mississippi. Mississippi State Geol. Survey Bull. 20 (140 pp.).

Mettee, M. F. 1978. The fishes of the Birmingham-Jefferson County region of Alabama with ecologic and taxonomic notes. Geol. Survey Alabama Bull. 115 (182 pp.).

Mettee, M. F., S. C. Harris, and P. E. O'Neil. 1986. Biological diversity and water quality of streams draining the Gilbertown oil field area. Geol. Survey Alabama Circular 120 (32 pp.).

Mettee, M. F., P. E. O'Neil, and S. C. Harris. 1983. A biological inventory of streams draining the Citronelle, Pollard, and Gilbertown oil fields in Alabama. Geol. Survey Alabama Circular 108 (101 pp.).

Mettee, M. F., P. E. O'Neil, J. M. Pierson, and R. D. Suttkus. 1989a. Fishes of the Black Warrior River system in Alabama. Geol. Survey Alabama Bull. 133 (201 pp.).

Mettee, M. F., P. E. O'Neil, J. M. Pierson, and R. D. Suttkus. 1989b. Fishes of the western Mobile River basin in Alabama and Mississippi. Geol. Survey Alabama Atlas 24 (170 pp.).

Mettee, M. F., P. E. O'Neil, R. D. Suttkus, and J. M. Pierson. 1987. Fishes of the lower Tombigbee River system in Alabama and Mississippi. Geol. Survey Alabama Bull. 107 (186 pp.).

O'Neil, P. E., S. C. Harris, and M. F. Mettee. 1984. The distribution and abundance of aquatic organisms inhabiting streams draining the Citronelle oil field, Alabama. Geol. Survey Alabama Circular 99 (26 pp.).

Page, L. M. 1983. Handbook of Darters. T. F. H. Publications, Inc. Neptune City, New Jersey (271 pp.).

Page, L. M. and B. M. Burr. 1991. A Field Guide to Freshwater Fishes, North America, North of Mexico. Houghton Mifflin Co., Boston, Mass. (432 pp.).

Pierson, J. M., W. M. Howell, R. A. Stiles, M. F. Mettee, P. E. O'Neil, R. D. Suttkus, and J. S. Ramsey. 1989. Fishes of the Cahaba River system in Alabama. Geol. Survey Alabama Bull. 134 (183 pp.).

Randolph, K. N. and M. L. Kennedy. 1974. The fishes of the Tippah River system Mississippi, with notes on habitats and distribution. J. Mississippi Acad. Sci. 19: 128-134.

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada (5th ed.). Amer. Fish. Soc. Spec. Publ. 20: 1-183.

Simons, A. M. 1992. Phylogenetic relationships of the *Boleosoma* species group (Percidae: *Etheostoma*). *In* R. L. Mayden (ed.), Systematics, Historical Ecology, and North American Freshwater Fishes (pp. 268-292). Stanford Univ. Press.

Smith-Vaniz, W. F. 1968. Freshwater Fishes of Alabama. Auburn Univ. Agric. Experiment Sta. (211 pp.).

Suttkus, R. D. and R. M. Bailey. 1993. *Etheostoma colorosum* and *E. bellator*, two new darters, subgenus *Ulocentra*, from southeastern United States. Tulane Stud. Zool. Bot. 29: 1-28.

Suttkus, R. D. and H. T. Boschung. 1990. *Notropis ammophilus*, a new cyprinid fish from southeastern United States. Tulane Stud. Zool. Bot. 27: 49-63.

Suttkus, R. D. and D. A. Etnier. 1991. *Etheostoma tallapoosae* and *E. brevirostrum*, two new darters, subgenus *Ulocentra*, from the Alabama River drainage. Tulane Stud. Zool. Bot. 28: 1-24.

FISHES OF THE BUFFALO RIVER SYSTEM, WILKINSON COUNTY, SOUTHWESTERN MISSISSIPPI

Mark A. Warren
Austin Community College, Cedar Park, TX 78613

Robert C. Cashner
Department of Biological Sciences, University of New Orleans, New Orleans, LA 70148

and

Royal D. Suttkus
Museum of Natural History, Tulane University, Belle Chasse, LA 70037

Abstract

The occurrence and distribution of the fishes of the Buffalo River in southwestern Mississippi were determined from two major surveys conducted from 1968-1971 and 1986-1991, as well as museum and literature records. In all, 95 species, from 20 families and 50 genera, were documented from the Buffalo River system. Cyprinids, centrarchids, poeciliids, fundulids, and clupeids were numerically dominant in both surveys. Longitudinal distribution of fishes in Buffalo River showed progressive downstream addition, with a large-scale replacement in the lower reaches. Monthly collections were made at six permanent stations from September 1986 to October 1987. Community similarity indices revealed relatively low faunal similarity between upper and lower sections of Buffalo River, and a strong pattern of seasonal variation in the lower section of the river.

Introduction

The importance of the Mississippi River in fish biogeography has been discussed in detail (Guillory, 1978, 1982; Grady et al., 1983; Conner and Suttkus, 1986). Fishes have been surveyed in several tributaries to the eastern part of the Mississippi River in Mississippi and Louisiana (Guillory, 1981, 1982; Grady et al., 1983; Cashner et al., 1979; Grady and Cashner, 1988; Ebert et al., 1985; Matthews, 1978), but only a few of the detailed results of these surveys have been published.

Buffalo River (or Buffalo Bayou) is the lowermost eastern major tributary to the Mississippi River. Fish collections were made sporadically in the Buffalo River by R. D. Suttkus and students at Tulane University in the mid-1950's and early 1960's. The first comprehensive survey of the drainage was from November 1968 to July 1971, in which 68 collections were made at 17 sites located primarily in the upper and middle reaches of the river (Cashner et al., 1976). The present study included a second major survey conducted from September 1986 to November 1991. During this period, 140 collections were made

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at 60 different localities; 82 collections were made during monthly samples at 6 stations from September 1986 to October 1987. The two surveys represent a combined total of 208 collections at 60 localities. The purpose of this paper is to present a list of species for the Buffalo River drainage, to document the pattern of distribution of these species, and to assess seasonal variation in the fish assemblages at the six stations sampled monthly from 1986-1987. A paper currently in preparation will compare the results of the two major surveys and assess the changes in fish assemblages over a time span of nearly two decades.

Study Area

Except for extreme headwaters in Amite County, Buffalo River is within Wilkinson County, Mississippi (Figure 1). The spring-fed headwaters of the river originate in a forested area, 3.5 miles north of Centreville, Mississippi. The river flows in a westerly direction, then north, increasing in size to a 4th-order stream (based on Strahler, 1957) as it receives runoff from small creeks and its first major tributary, Little Buffalo River. Buffalo River continues to flow northward, gradually increasing in width and depth. Near the vicinity of the Mississippi Highway 563 bridge, the river starts a northwesterly course and continues in this direction until it divides into several channels and forms a series of bald cypress dominated swamps near Lessley, Mississippi. Then the river flows southwesterly to Lake Mary, an ox-bow lake formed from the Mississippi River, which is also connected to the Homochitto River to the north. After Lake Mary, Buffalo River flows nearly due south, entering the Mississippi River near River Mile

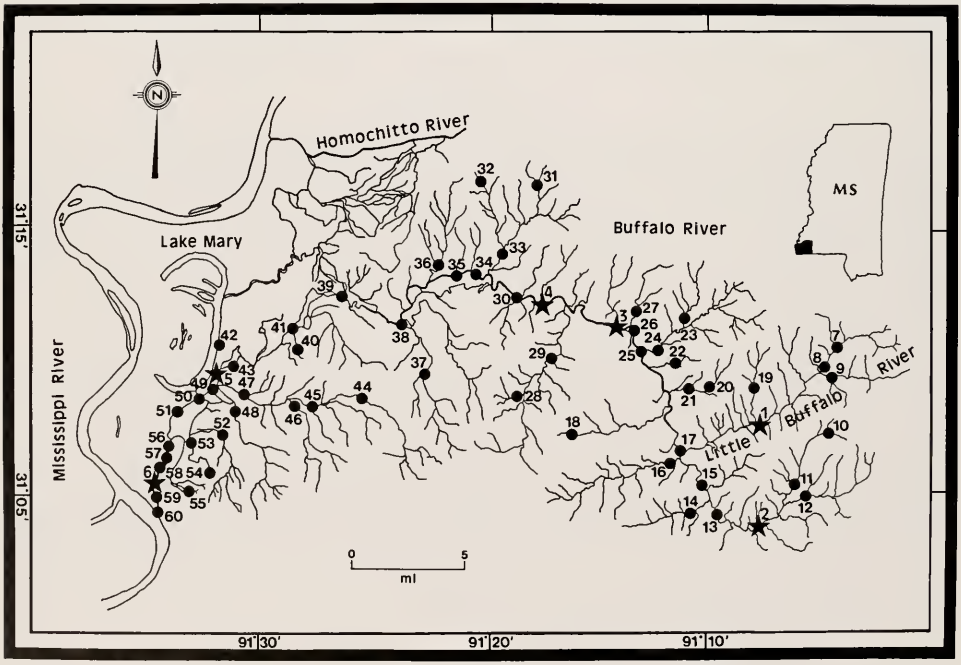

Figure 1. Map of Buffalo River, Wilkinson County, Mississippi, with collecting localities indicated.

313, approximately 1.5 miles southwest of Fort Adams, Mississippi. The elevation of the Buffalo River is 380 feet at the headwaters and 25 feet at the confluence with the Mississippi River. The average gradient is 5.6 feet/mile and the watershed area is approximately 344 square miles.

The river crosses several geological formations along its course. Headwaters are characterized by deep cut banks, a narrow channel, relatively clear water, and alternating pool, raceway, and riffle-type habitats. Here the stream exposes the alluvial sands and gravels of the Citronelle formation (Brown and Guyton, 1943; Fisk, 1951; Sibley, 1972). Sand is the dominant substrate throughout the upper headwaters, however, gravel is relatively abundant in riffle areas, and hard packed clays are found in some raceways. Farther downstream, the river traverses broad depositional Pleistocene terraces formed by Mississippi River sediments (Fisk, 1951; Sibley, 1972). The terraces, as well as the Citronelle formation to the east, are covered by loess soils (Snowden and Priddy, 1968). In this section, the river becomes larger, wider, more turbid, and mixed gravel substrates are replaced by shifting sand and mud. The lower reaches of Buffalo River cut through the recent alluvial floodplain of the Mississippi River (Fisk, 1944, 1951; Sibley, 1972). In the lower section, water levels fluctuate dramatically and are directly influenced by the Mississippi River. Slow, turbid water flowing over soft mud substrate, rich in organic detritus, is characteristic of this reach.

Terrestrial vegetation providing stream cover is abundant in the middle to upper regions of Buffalo River. A mixed coniferous-hardwood forest makes up most of the stream canopy. Aquatic vegetation is occasionally present in the upper portions of the river, with blooms of floating pond-scum (*Spirogyra* sp.) common during the spring and summer. Upland pine forest is gradually replaced by cypress-hardwood in the lower reaches of Buffalo River. Black willow (*Salix nigra*), eastern cottonwood (*Populus deltoides*) and bald cypress (*Taxodium distichum*) dominate. Aquatic vegetation is also abundant, with duck-weed (*Lemna* sp.), smart-weed (*Polygonum* sp.), duck-potato (*Sagittaria latifolia*), coon-tail (*Ceratophyllum demersum*) and American lotus (*Nelumbo lutea*) most prevalent (Caplenor et al., 1968; Fassett, 1957).

Materials and Methods

At each locality, during both surveys, a 650-1300 foot longitudinal reach of the stream was seined for approximately 1.0-1.5 hours or until all of the major macrohabitats were sampled. Collections were made using seines 10-50 feet long of 3/16 inch or 1/4 inch mesh. During the latter survey, in 1987, monofilament nylon gillnets, 150 feet × 6 feet with a 2 inch square mesh, were set at stations 5 and 6 on two different occasions (Figure 1). Monthly collections, from September 1986 to October 1987, were made at six stations established from the upper reaches of Buffalo River to near its confluence with the Mississippi River (Figure 1).

Specimens were fixed in the field with 10% formalin and stored for one week, then washed and transferred to 50% isopropyl alcohol for permanent storage. Nomenclature used in this paper follows Robins et al. (1991), except for the recognition of the families Fundulidae and Elassomatidae. All specimens collected during this study were deposited in the Vertebrate Collection at the University of New Orleans (UNOVC) or the Tulane Museum of Natural History (TU). Detailed locations of all 60 collecting sites are given in the Appendix.

Analyses of Data

Morisita's Index (I_m) and percent similarity index (PSI) were used to assess faunal similarity between stations 1-6. All species were included in the analysis following Matthews (1986a). Indices of similarity have been widely used in comparing sites within and between streams. Although the ranges of values considered by different authors to be high vary somewhat, we follow Matthews et al. (1988) in using values greater than 0.7 for PSI and I_m as indicative of relatively high degree of similarity between stations. Diversity indices (H′) were calculated (to the log base 2) for stations 1-6 (Shannon and Weaver, 1962).

Results

A total of 71,559 specimens of 74 species in 17 families was recorded from the Buffalo River drainage in the 1968-1971 survey, and in the 1986-1991 survey, 60,830 specimens of 88 species in 17 families were collected. Based on the two surveys, plus museum and literature records, the known ichthyofauna for the Buffalo River presently stands at 95 species in 20 families (Table 1).

Cyprinidae was the dominant family, both in number of species represented (26% of total) and individuals (74% of total) collected during the two surveys. The three numerically dominant species, *Cyprinella camura, Notropis longirostris,* and *Cyprinella venusta,* made up 54% of the total specimens. The cyprinids were followed by Fundulidae and Poeciliidae (5% each) and Centrarchidae (6%) in number of individuals. The Percidae, with 17%, and the Centrarchidae, with 14%, ranked second and third, respectively, behind the cyprinids in number of species represented.

During the survey of 6 permanent stations in 1986-1987, 82 collections were made yielding 79 species in 15 families (Table 2). There was an obvious change in the numerical dominance of species between the upper, middle, and lower reaches of the Buffalo River (Table 2). At stations 1 and 2, *Cyprinella camura* and *Notropis longirostris* were the most abundant and accounted for 54% of the specimens captured. At stations 3 and 4, the numerical abundance of *Cyprinella camura* and *Notropis longirostris* decreased, and *Cyprinella venusta* and *Hybognathus nuchalis* increased. These two species comprised 52% of the total specimens collected at stations 3 and 4, compared with 26% for *Cyprinella camura* and *Notropis longirostris.* In the lower portions of the river, at stations 5 and 6, *Dorosoma petenense, Gambusia affinis,* and *Lepomis macrochirus* were the most abundant forms taken.

There was virtually no similarity between the upper and middle stations 1-4, (Figure 1) and the lower ones (5 and 6, Table 3). I_m values among the upper four sites ranged from 0.34-0.94. In all but a few cases the PSI estimates were lower than I_m, as predicted by Linton et al. (1981). Only stations 1 and 2 and 3 and 4 had both I_m and PSI values suggesting relatively high faunal similarity. Based on the I_m alone, stations 1 and 2 and 1 and 3 could be regarded as highly similar to each other. Stations 5 and 6 were the only other paired stations that had I_m values near 0.70.

The most dissimilar adjacent stations were 4 and 5 ($I_m = 0.20$; PSI $= 0.17$), which had only 40% of their species in common. *Cyprinella venusta* and *Hybognathus nuchalis* accounted for 56% of the specimens taken at Station 4, but only 5% at Station 5. *Notropis texanus* (11%) and *Lythrurus fumeus* (7%) were the most common cyprinids at Station 5, and slow-water forms, such as *Gambusia affinis, Labidesthes sicculus,* and *Lepomis macrochirus,* made up nearly 50% of the catch (compared to about 7% at Station 4).

The number of species per site, for the six permanent stations, increased gradually from 30 to 37 downstream from Station 1 to Station 4, which was located near the end of the lower middle reaches of Buffalo River (Table 4). The number of species increased to 47 at Station 5 and was virtually the same at Station 6. Species diversity was highest at Station 5 ($H' = 2.56$); values at the other 5 stations varied from 2.02 to 2.15.

Seasonal Variation at Six Stations.

Similarity across seasons in the fish assemblages at the six stations was examined for species collected monthly by seines from October 1986 to September 1987. The year was divided into four seasons, autumn (September-November), winter (December-February), spring (March-May), and summer (June-August) (Table 5). Streamwide, the species richness and abundance were highest in the summer and autumn, with 61 species and 12,352 specimens, and 63 species and 8190 specimens, respectively. Fifty-eight species and 7398 specimens were taken in spring, and the winter season yielded 3188 specimens, representing 45 species.

The greatest stability in fish assemblages for the 12-month period occurred at Station 2 (Table 5). The I_m values among all seasons were high for this station (0.80 – 0.93). For Station 1, autumn-winter and winter-spring I_m values averaged 0.90, but the summer assemblage was much more variable, with I_m for spring-summer of 0.60 and 0.67 for summer-autumn. The faunal similarity at the middle sites, stations 3 and 4, was also highest between autumn, winter, and spring samples ($x = 0.75$) and lowest between the summer and the other seasons ($x = 0.48$). The lower stations, 5 and 6, were the most variable between seasons. Only autumn and winter samples at Station 5 had high similarity (0.92). The comparisons of faunal assemblages for the other seasonal pairings at these two stations ranged from 0.04 – 0.61 ($x = 0.32$). The greatest seasonal variability was at Station 6, where I_m values for the four seasons averaged just 0.25.

Longitudinal Distribution of Fishes.

Species richness in Buffalo River increases from the headwaters to the mouth. Thirty species were recorded at Station 1, and 51 by Station 4, where the river channel becomes noticeably wider and deeper (Table 4). A rather striking change in the fish fauna occurs between stations 4 and 5, where the river takes on a more distinctive lowland character. Stations 5 and 6 had the highest species number, with a total of 47 and 45 species, respectively. At these two lower stations, 28 species not collected in the upper and middle portions were added, bringing the total for the six permanent stations to 79.

Only six species appeared to be restricted to the upper reaches, and 14 others were more or less confined to the upper and middle portions, stations 1-4, of the stream course (Table 2). A group of 35 species was found primarily in the lower reaches, at stations 5 and 6, and 13 species were distributed throughout all of the six stations or were absent from only one site (Table 2).

Discussion

The general pattern of species addition has been documented in many studies for rivers and streams in the eastern and central United States (e.g., Larimore and Smith, 1963; Sheldon, 1968; Jenkins and Freeman, 1972). The Buffalo River exhibits a pattern of increased species richness downstream ac-

TABLE 1. Abundance of fish species recorded from Buffalo River, Mississippi, in 1968-1971 and 1986-1991 surveys. Asterisk indicates species based on catch by commercial fishermen or museum record.

Family and Species	Number of Specimens 1968-1971	1986-1991	Total
Petromyzontidae (lampreys)			
Ichthyomyzon gagei	15	9	24
Lampetra aepyptera	12	2	14
Polyodontidae (paddlefishes)			
*Polyodon spathula**	0	5	5
Lepisosteidae (gars)			
Lepisosteus oculatus	2	36	38
Lepisosteus osseus	0	2	2
Lepisosteus platostomus	0	3	3
Amiidae (bowfins)			
Amia calva	3	0	3
Anguillidae (freshwater eels)			
Anguilla rostrata	3	0	3
Clupeidae (herrings)			
Alosa chrysochloris	1	6	7
Dorosoma cepedianum	14	115	129
Dorosoma petenense	366	3695	4061
Cyprinidae (carps & minnows)			
*Campostoma anomalum**	0	1	1
Cyprinella camura	22427	5328	27755
Cyprinella lutrensis	25	871	896
Cyprinella venusta	11304	7846	19150
Cyprinus carpio	0	3	3
Hybognathus hayi	2	22	24
Hybognathus nuchalis	340	6781	7121
Luxilus chrysocephalus	2372	2843	5215
Lythrurus fumeus	53	1051	1104
Lythrurus umbratilis	85	330	415
Macrhybopsis storeriana	0	3	3
Nocomis leptocephalus	1569	1085	2654
Notemigonus crysoleucas	7	358	365
Notropis atherinoides	15	57	72
Notropis blennius	0	182	182
Notropis buchanani	1	0	1
Notropis longirostris	18910	5987	24897
Notropis shumardi	19	631	650
Notropis texanus	27	1715	1742
Notropis volucellus	405	280	685
Notropis winchelli	114	332	446
Opsopoeodus emiliae	55	316	371
Pimephales notatus	538	390	928
Pimephales vigilax	2061	1337	3398
Semotilus atromaculatus	57	267	324
Catostomidae (suckers)			
Carpiodes carpio	21	11	32
Erimyzon oblongus	62	20	82
Hypentelium nigricans	79	18	97
Ictiobus bubalus	9	156	165
Minytrema melanops	2	44	46
Moxostoma poecilurum	32	17	49
Ictaluridae (catfishes)			
Ameiurus melas	0	6	6
Ameiurus natalis	26	108	134
Ictalurus furcatus	1	1	2
Ictalurus punctatus	9	126	135
Noturus gyrinus	0	10	10
Noturus miurus	1585	113	1698

TABLE 1. (Continued)

Family and Species	Number of Specimens 1968-1971	1986-1991	Total
Noturus phaeus	277	84	361
Pylodictis olivaris	1	3	4
Esocidae (pikes & pickerels)			
*Esox americanus**	0	0	1
Aphredoderidae (pirate perches)			
Aphredoderus sayanus	26	94	120
Fundulidae (killifishes)			
Fundulus catenatus	2652	1145	3797
Fundulus chrysotus	0	533	533
Fundulus dispar	0	372	372
Fundulus notatus	13	171	184
Fundulus olivaceus	1457	541	1998
Poeciliidae (livebearers)			
Gambusia affinis	639	6530	7169
Atherinidae (silversides)			
Labidesthes sicculus	78	1301	1379
Menidia beryllina	46	415	461
Syngnathidae (pipefishes)			
Syngnathus scovelli	4	22	26
Percichthyidae (temperate basses)			
Morone chrysops	2	61	63
Morone mississippiensis	0	5	5
Morone saxatilis	0	7	7
Centrarchidae (sunfishes)			
Ambloplites ariommus	2	0	2
Lepomis cyanellus	107	84	191
Lepomis gulosus	25	62	87
Lepomis humilis	15	30	45
Lepomis macrochirus	461	4648	5109
Lepomis megalotis	975	508	1483
Lepomis microlophus	21	192	213
Lepomis punctatus	0	233	233
Lepomis symmetricus	0	72	72
Micropterus punctulatus	364	74	438
Micropterus salmoides	15	223	248
Pomoxis annularis	1	185	186
Pomoxis nigromaculatus	2	112	114
Elassomatidae (pygmy sunfishes)			
Elassoma zonatum	1	2	3
Percidae (perches & darters)			
Ammocrypta beani	352	48	400
Etheostoma chlorosomum	2	52	54
Etheostoma fusiforme	0	5	5
Etheostoma gracile	2	3	5
Etheostoma histrio	0	2	2
Etheostoma lynceum	495	74	569
Etheostoma parvipinne	14	3	17
Etheostoma proeliare	10	26	36
Etheostoma stigmaeum	138	71	209
Etheostoma swaini	72	76	148
Etheostoma whipplei	87	64	151
Percina caprodes	0	1	1
Percina sciera	571	99	670
Percina shumardi	0	1	1
Percina vigil	0	50	50
Stizostedion canadense	1	0	1
Sciaenidae (drums)			
Aplodinotus grunniens	3	23	26
Total			132,396

TABLE 2. Species and number of specimens collected during the 1986-1987 survey at six permanent stations in Buffalo River, Mississippi.

	Station						
	1	2	3	4	5	6	Total
Ichthyomyzon gagei		4					4
Lampetra aepyptera	1						1
Lepisosteus oculatus					2	23	25
L. osseus					1		1
L. platostomus					1	1	2
Alosa chrysochloris						6	6
Dorosoma cepedianum					18	78	96
D. petenense					7	2750	2757
Cyprinella camura	1208	964	1094	945			4211
C. lutrensis				2	96	47	145
C. venusta	282	94	1515	2682	103	496	5172
Cyprinus carpio			2				2
Hybognathus hayi				1	4	4	9
H. nuchalis	538		843	2035	334	26	3776
Luxilus chrysocephalus	211	635	91	54			991
Lythrurus fumeus	6			14	590	58	668
L. umbratilis	12		274	8			294
Nocomis leptocephalus	144	438	5				587
Notemigonus crysoleucas		3	7		4	187	201
Notropis atherinoides					11	28	39
N. blennius						182	182
N. longirostris	1086	1364	742	807			3999
N. shumardi						631	631
N. texanus			2	156	928	189	1275
N. volucellus		1	14	232		7	254
N. winchelli	24	2	71	152			249
Opsopoeodus emiliae					256	38	294
Pimephales notatus	38	63	43	81	3		228
P. vigilax		1	145	416	117	80	759
Semotilus atromaculatus	10	2					12
Carpiodes carpio				1	1	9	11
Erimyzon oblongus	3	1	2				6
Hypentelium nigricans	3	11	2				16
Ictiobus bubalus						151	151
Minytrema melanops					41		41
Moxostoma poecilurum			2	6	6		14
Ameiurus natalis		5			1		6
Ictalurus punctatus		1	2	16	2	9	30
Noturus gyrinus				1	4		5
N. miurus	19	67					86
N. phaeus	3	67					70
Aphredoderus sayanus	1			1	26		28
Fundulus catenatus	310	363	30	17			720
F. chrysotus					429	12	441
F. dispar					273		273
F. notatus			2	3	141	15	161
F. olivaceus	107	94	50	69	2		322
Gambusia affinis	12	8	260	459	1733	2587	5059
Labidesthes sicculus				45	803	81	929
Menidia beryllina					105	184	289
Syngnathus scovelli					20	1	21
Morone chrysops						58	58
M. mississippiensis						1	1
M. saxatilis						1	1
Lepomis cyanellus	21	23	10			5	59
L. gulosus				4	18	1	23
L. humilis					24	1	25

TABLE 2. (Continued)

	Station						
	1	2	3	4	5	6	Total
L. macrochirus	21	45	32	56	1637	2505	4296
L. megalotis	80	17	35	72	126	23	353
L. microlophus					139	8	147
L. punctatus				1	222	1	224
L. symmetricus					50		50
Micropterus punctulatus	1	11	7	26	4		49
M. salmoides		1	7	1	67	125	201
Pomoxis annularis						179	179
P. nigromaculatus					6	58	64
Ammocrypta beani	2	2	9	22			35
Etheostoma chlorosomum					9	1	10
E. gracile				1		1	2
E. lynceum	19	33	1	2			55
E. parvipinne			1				1
E. proeliare					19	1	20
E. stigmaeum		2	1				3
E. swaini	6	2	4	4		5	21
E. whipplei	4	7	9	2	1		23
Percina caprodes					1		1
P. sciera	32	12	14	13			71
P. vigil	30	3	2	5			40
Aplodinotus grunniens					1	10	11
Totals	4234	4346	5328	8412	8388	10864	41572

TABLE 3. Community similarity indices for the six permanent stations for Buffalo River, Mississippi, 1986-1987. First value I_m, PSI in parentheses.

Station	1	2	3	4	5	6
1	---					
2	.89(.72)	---				
3	.77(.61)	.55(.43)	---			
4	.60(.46)	.34(.28)	.94(.79)	---		
5	.05(.08)	.02(.03)	.15(.13)	.20(.17)	---	
6	.03(.06)	.02(.04)	.15(.12)	.16(.15)	.67(.50)	---

TABLE 4. Species richness and Shannon Diversity (H′) for collections made during the 1986-1987 survey at the six permanent stations, Buffalo River, Mississippi.

Station	Species Site	Total Species for Drainage	N	H′
1	30	30	4234	2.114
2	33	38	4346	2.026
3	34	42	5328	2.077
4	37	51	8412	2.068
5	47	71	8388	2.563
6	45	79	10864	2.148

TABLE 5. Seasonal similarity (I_m) for the six permanent stations, Buffalo River, Mississippi, during 1986-1987.

Station	Aut-Win	Win-Spr	Spr-Sum	Sum-Aut	Mean
1	.91	.89	.60	.67	.77
2	.92	.80	.93	.90	.89
3	.75	.92	.43	.68	.70
4	.71	.61	.36	.44	.53
5	.92	.22	.27	.61	.51
6	.40	.37	.04	.18	.25

companied by an abrupt change in faunal components in the lowermost reaches. The major replacement of species between stations 4 and 5 is associated with the river becoming more lowland in character. A cypress swamp located at Station 5 probably acts as a natural barrier to fishes adapted to higher gradient conditions (Guillory, 1978; Matthews and Styron, 1981). Ichthyofaunal surveys conducted in drainages adjacent to the Buffalo River have shown similar patterns of species distribution (e.g., Guillory, 1982; Grady et al., 1983).

A downstream increase in species diversity occurs in most lotic systems (Hynes, 1970; Hawkes, 1975; Horwitz, 1978), and this pattern is reflected in samples at the six permanent stations on Buffalo River. Various authors have suggested that such patterns are due to an increase in available habitat or trophic diversity (Kuehne, 1962; Sheldon, 1968; Horwitz, 1978). Increasing stream size and habitat heterogeneity, along with the less variable physicochemical environment found in the lower mainstream, produces a more temporally stable environment, as compared to the headwaters, and could partially explain the high species richness and diversity values seen for stations 5 and 6 (Sheldon, 1968; Evans and Noble, 1979; Matthews and Styron, 1981; Schlosser, 1987). Some authors have suggested that characteristics of local fish assemblages are strongly related to stream order (Kuehne, 1962; Harrel et al., 1967; Whiteside and McNatt, 1972), and that stream order represents a discrete biological unit for fishes (Lotrich, 1973). We found no evidence of changes in fish assemblages correlated with changes in stream order using methods described in Matthews (1986b). The striking differences in faunal composition between stations 4 and 5 are partially enhanced by the distance between the sampling sites (21 miles) rather than just a sudden change in environmental conditions. Later collections, made between stations 4 and 5, revealed a more gradual change in the fish assemblages.

Stations 5 and 6 exhibited the greatest faunal change when compared to the other four permanent stations. Guillory (1982) concluded that transients from the faunally rich Mississippi River and adjacent floodplain were largely responsible for the high diversity at sites along Thompson Creek similar in habitat complexity to stations 5 and 6.

The diversity and species recorded for Buffalo River (95) is comparable to the richest faunas reported for tributaries to the lower eastern Mississippi River, e.g., Thompson Creek (89 species; Guillory, 1981), Bayou Sara (80 species; Grady et al., 1983), Homochitto River (105 species; Ebert et al., 1985), and Bayou Pierre (95 species; Matthews, 1978).

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Literature Cited

Baker, J. A. and S. T. Ross. 1981. Spatial and temporal resource utilization by southeastern cyprinids. Copeia 1981: 178-189.

Brown, G. F. and W. F. Guyton. 1943. Geology and ground-water supply at Camp Van Dorn. Mississippi Geol. Surv. Bull. 56: 9-68.

Caplenor, C., D. R. E. Bell, J. Brook, D. Caldwell, C. Hughes, A. Regan, A. Scott, S. Ware, and M. Wells. 1968. Forests of west central Mississippi as affected by loess. *In* W. H. Moore, ed. Loess Investigations in Mississippi (pp. 205-267). Mississippi Geol., Econ. and Topogr. Surv. Bull. 111.

Cashner, R. C., J. S. Rogers, and M. T. Sobczak. 1976. The fishes of Buffalo Bayou in western Mississippi. ASB Bull. 23: 48.

Cashner, R. C., R. D. Suttkus, F. L. Pezold, and J. M. Grady. 1979. The status of the southern redbelly dace, *Chrosomus erythrogaster*, in Mississippi. Proc. Southeastern Fishes Council 3: 1-3.

Conner, J. V. and R. D. Suttkus. 1986. Zoogeography of freshwater fishes of the western gulf slope. *In* C. H. Hocutt and E. O. Wiley, eds. Zoogeography of North American Freshwater Fishes (pp. 413-456) John Wiley and Sons, New York.

Ebert, D. J., R. M. Weill, and P. D. Hartfield. 1985. A checklist of fishes in the Homochitto River system. J. Mississippi Acad. Sci. 30: 103-110.

Edds, D. R. 1993. Fish assemblage structure and environmental correlates in Nepal's Gandaki River. Copeia 1993: 48-60.

Evans, J. W. and R. L. Noble. 1979. The longitudinal distribution of fishes in an eastern Texas stream. Amer. Midl. Nat. 101: 333-343.

Fassett, N. C. 1957. A Manual of Aquatic Plants. Univ. Wisconsin Press, Madison (405 pp.).

Fisk, H. N. 1944. Geological investigations of the alluvial valley of the lower Mississippi River. Mississippi River Community, War Dept., Corps of Engineers, U.S. Army (63 pp.).

Fisk, H. N. 1951. Loess and Quaternary geology of the lower Mississippi Valley. J. Geology 59: 333-356.

Gorman, O. T. and J. R. Karr. 1978. Habitat structure and stream fish communities. Ecology 59: 507-515.

Grady, J. M. and R. C. Cashner. 1988. Evidence of extensive intergeneric hybridization among the cyprinid fauna of Clark Creek, Wilkinson Co., Mississippi. Southwest. Nat. 33: 137-146.

Grady, J. M., R. C. Cashner, and J. S. Rogers. 1983. Fishes of the Bayou Sara drainage, Louisiana and Mississippi, with a discriminant functions analysis of factors influencing species distribution. Tulane Stud. Zool. Bot. 24: 83-100.

Guillory, V. 1978. New interpretations of fish dispersal via the lower Mississippi River. Florida Sci. 41: 96-100.

Guillory, V. 1981. A checklist of fishes of Thompson Creek, Louisiana, with zoogeographical comments. Proc. Louisiana Acad. Sci. 44: 37-47.

Guillory, V. 1982. Longitudinal gradients of fishes in Thompson Creek, Louisiana. Southwest. Nat. 27: 107-115.

Harrel, R. C., B. J. Davis, and T. C. Dorris. 1967. Stream order and species diversity of fishes in an intermittent Oklahoma stream. Amer. Midl. Nat. 78: 428-438.

Hawkes, H. A. 1975. River zonation and classification. *In* B. A. Whitton, ed. River Ecology (pp. 312-374). Univ. California Press, Berkeley.

Horwitz, R. J. 1978. Temporal variability patterns and the distributional patterns of stream fishes. Ecol. Monogr. 48: 307-321.

Hynes, H. B. N. 1970. The Ecology of Running Waters. Univ. Toronto, Canada (555 pp.).

JENKINS, R. AND C. FREEMAN. 1972. Longitudinal distribution and habitat of the fishes of Mason Creek, an upper Roanoke River drainage tributary. Virginia J. Sci. 23: 194-202.
KUEHNE, R. A. 1962. A classification of streams, illustrated by fish distribution in an eastern Kentucky stream. Ecology 43: 608-614.
LARIMORE, R. W. AND P. W. SMITH, 1963. The fishes of Champaign County, Illinois, as affected by sixty-two years of stream changes. Bull. Illinois Nat. Hist. Surv. 28: 299-382.
LINTON, L. R., R. W. DAVIES, AND F. J. WRONA. 1981. Resource utilization indices: an assessment. J. Animal Ecol. 50: 283-292.
LOTRICH, V. A. 1973. Growth, production and community composition of fishes inhabiting a first-, second-, and third-order stream of eastern Kentucky. Ecol. Monogr. 43: 377-397.
MATTHEWS, W. H. 1978. Fishes of Bayou Pierre, southwest Mississippi. Unpublished M.S. thesis, Northeast Louisiana Univ. Monroe (124 pp.).
MATTHEWS, W. J. 1986a. Fish faunal structure in an Ozark stream: stability, persistence, and a catastrophic flood. Copeia 1986: 388-397.
MATTHEWS, W. J. 1986b. Fish faunal "breaks" and stream order in the eastern and central United States. Envir. Biol. Fishes 17: 81-92.
MATTHEWS, W. J., R. C. CASHNER, AND F. P. GELWICK. 1988. Stability and persistence of fish faunas and assemblages in three midwestern streams. Copeia 1988: 945-955.
MATTHEWS, W. J. AND J. T. STYRON, JR. 1981. Tolerance of headwaters versus mainstream fishes for abrupt physiochemical changes. Amer. Midl. Nat. 105: 149-158.
ROBINS, C. R., R. M. BAILEY, C. E. BOND, J. R. BROOKER, E. A. LACHNER, R. N. LEA, AND W. B. SCOTT. 1991. Common and scientific names of fishes from the United States and Canada (5th ed.). Amer. Fish. Soc. Spec. Publ. No. 20: 1-183.
ROGERS, J. S., R. C. CASHNER, AND M. SOBCZAK. 1976. Multivariate analysis of fish distribution patterns in a small stream system. Amer. Zool. 16: 269.
SCHLOSSER, I. J. 1987. A conceptual framework for fish communities in small warmwater streams. *In* W. J. Matthews and D. C. HEINS, eds. Community and Evolutionary Ecology of North American Stream Fishes (pp. 17-24). Univ. Oklahoma Press, Norman (310 pp.).
SHANNON, C. E. AND W. WEAVER. 1962. The Mathematical Theory of Communication. Univ. Illinois Press, Urbana (117 pp.).
SHELDON, A. L. 1968. Species diversity and longitudinal succession in stream fishes. Ecology 49: 193-198.
SIBLEY, J. H. 1972. A study of the geology of Baton Rouge and surrounding southeast Louisiana area. Claitor's Publ. Div., Baton Rouge (358 pp.).
SNOWDEN, J. O., JR. AND R. R. PRIDDY. 1968. Geology of Mississippi loess. *In* W. H. Moore, ed. Loess Investigations in Mississippi (pp. 13-203). Mississippi Geol., Econ. and Topogr. Surv. Bull. 111.
STRAHLER, A. A. 1957. Quantitative analysis of watershed geomorphology. Trans. Amer. Geophys. Union 38: 913-920.
WHITESIDE, B. E. AND R. M. MCNATT. 1972. Fish species diversity in relation to stream order and physiochemical conditions in the Plum Creek drainage basin. Amer. Midl. Nat. 88: 90-101.

APPENDIX. Locations of collection sites in Mississippi. Stations 1-6 (1-6 in Figure 1) were sampled monthly during 1986-1987, and at least one collection was made at the other 54 sites identified as 7-60 in Figure 1.

Station 1: Little Buffalo River at Macedonia Road, 2.8 miles west of Centreville, and 6.4 miles north of Highway 24 (T2N, R1E, Sec 5). **Station 2:** Buffalo River at Hiram-McGraw Road, 2.8 miles west of Centreville, 1.4 miles north of Highway 24 (T2N, R1E, Sec 34). **Station 3:** Buffalo River at Highway 563, 0.5 miles south of Wilkinson (T3N, R1W, Sec 17). **Station 4:** Buffalo River at US Highway 61, 8.5 miles north of Woodville (T3N, R2W, Sec 21). **Station 5:** Buffalo River at Highway 24, 5.1 miles west of Lessley (T2N, R4W, Sec 10). **Station 6:** Buffalo River at Jackson Point Road, 1.9 miles west of Fort Adams (T2N, R5W, Sec 18). **Station 7:** Little Buffalo River at Bluff Springs Road, 3.4 miles west of Gloster (T3N, R1E, Sec 23). **Station 8:** Little Buffalo River at Lower Gloster Road, 3.5 miles west of Gloster (T3N, R1E, Sec 26). **Station 9:** Unnamed tributary to Little Buffalo River at Mt. Carmel Road, 3.3 miles west of Gloster (T3N, R1E, Sec 26). **Station 10:** Buffalo River at Dr. Anderson Road, 3.9 miles north of Centreville (T2N, R1E, Sec 11). **Station 11:** Buffalo River at Macedonia Road, 2.3 miles northwest of Centreville (T2N, R1E, Sec 24). **Station 12:** Smith Creek

at Macedonia Road, 1.2 miles northwest of Centreville (T2N, R1E, Sec 29). **Station 13:** Buffalo River at Willie Neyland Road, 1.5 miles north of Highway 24 (T2N, R1W, Sec 25). **Station 14:** Jackson Creek at White School Road, 1.0 miles north of Highway 24 (T2N, R1W, Sec 26). **Station 15:** Buffalo River at Jones-White Road, 3.0 miles north of Highway 24 (T2N, R1W, Sec 24). **Station 16:** Browns Creek at White School Road, 3.5 miles north of Highway 24 (T2N, R1W, Sec 15). **Station 17:** Buffalo River at Little Buffalo River confluence, at White School Road, 5.0 miles north of Highway 24 (T2N, R1W, Sec 14). **Station 18:** Dry Fork Creek at Highway 563, 3.2 miles north of Woodville or 0.6 mile north of Highway 61 at Highway 563 bridge (T2N, R2W, Sec 12). **Station 19:** Dixon Creek at Henley Road, 9.0 miles north of Highway 24 (T3N, R1E, Sec 32). **Station 20:** Caledonia Creek at William Anderson Road, 6.5 miles southwest of Wilkinson (T3N, R1W, Sec 40). **Station 21:** Caledonia Creek at William Anderson Road, 5.0 miles southwest of Wilkinson (T3N, R1W, Sec 39). **Station 22:** Willis Creek at Walter Anderson Road, 5 miles southwest of Wilkinson (T3N, R1W, Sec 30). **Station 23:** Piney Creek at Highway 563, 3.0 miles northwest of Wilkinson (T3N, R1W, Sec 14). **Station 24:** Dry Creek at Walter Anderson Road, 3.0 miles southeast of Wilkinson (T3N, R1W, Sec 25). **Station 25:** Buffalo River at Dry Creek confluence, at Walter Anderson Road, 3.6 miles southeast of Wilkinson (T3N, R1W, Sec 31). **Station 26:** Buffalo River at Otis Jackson Road, 2.0 miles southeast of Wilkinson (T3N, R1W, Sec 17). **Station 27:** Silver Creek at Highway 563, 1.0 mile east of Wilkinson (T3N, R1W, Sec 16). **Station 28:** Fords Creek at Fords Creek Road, 3.6 miles north of Woodville (T2N, R2W, Sec 3). **Station 29:** Fords Creek at US Highway 61, 6.6 miles north of Woodville (T3N, R2W, Sec 41). **Station 30:** Buffalo River at Mill Creek confluence, 1.4 miles west of US Highway 61 (T3N, R2W, Sec 22). **Station 31:** Phipps Creek at Doloroso Road, 4.0 miles east of Doloroso (T4N, R2W, Sec 29). **Station 32:** Hazlit Creek at Doloroso Road, 0.7 mile east of Doloroso (T4N, R2W, Sec 26). **Station 33:** Big Piney Creek at US Highway 61, 4.0 miles southeast of Doloroso (T3N, R2W, Sec 5). **Station 34:** Buffalo River at Sanders Fork Road, 3.5 miles northeast of Lanehart (T3N, R2W, Sec 11). **Station 35:** Buffalo River 3.5 miles north of Lanehart (T3N, R2W, Sec 10). **Station 36:** Steels Creek at Woodlawn Road, 7.5 miles northeast of Lanehart (T3N, R3W, Sec 12). **Station 37:** Beaver Creek at Beaver Creek Road, 1.5 miles southwest of Lanehart (T3N, R3W, Sec 43). **Station 38:** Buffalo River at Beaver Creek confluence, 2.0 miles north of Beaver Creek Road (T3N, R3W, Sec 28). **Station 39:** Buffalo River at Southland Road, 5.0 miles north of Lessey (T3N, R3W, Sec 25). **Station 40:** Unnamed tributary to Buffalo River at Pleasant Valley Road, 3.0 miles north of Highway 24 (T3N, R4W, Sec 42). **Station 41:** Buffalo River at Pleasant Valley Road, 2.5 miles northwest of Highway 24 (T3N, R4W, Sec 27). **Station 42:** Lake Mary at Percy Creek-Sand Road, bridge at public boat ramp, 3.0 miles northwest of Highway 24 (T3N, R4W, Sec 36). **Station 43:** Unnamed cypress swamp lake, 3.7 miles north of Percy Creek-Sand Road (T2N, R4W, Sec 6). **Station 44:** Percy Creek 0.1 mile south of Highway 24 at Lessley (T2N, R3W, Sec 17). **Station 45:** Percy Creek at Bullet Branch confluence at Highway 24, 2.5 miles west of Lessley (T2N, R3W, Sec 12). **Station 46:** Hayes Creek at Highway 24, 3.0 miles west of Lessley (T2N, R4W, Sec 17). **Station 47:** Percy Creek at Percy Creek-Sand Road, 1.5 miles north of Highway 24 at Ford (T2N, R4W, Sec 6). **Station 48:** Smith Creek at Highway 24, 5.0 miles northwest of Fort Adams (T2N, R4W, Sec 20). **Station 49:** Buffalo River 0.6 mile south of Percy Creek-Sand Road bridge (T2N, R4W, Sec 10). **Station 50:** Bloomer Creek at Highway 24 bridge, 3.1 miles northeast of Fort Adams (T2N, R4W, Sec 21). **Station 51:** Belmont Lake at unmarked road, 1.3 miles northeast of Fort Adams (T2N, R4W, Sec 41). **Station 52:** Belmont Slough at unmarked road, 3.1 miles northeast of Fort Adams (T2N, R4W, Sec 27). **Station 53:** Buffalo River at confluence with Lake Mary Canal at unmarked road, 2.3 miles west of Highway 24, 4.9 miles northeast of Fort Adams (T2N, R4W, Sec 11). **Station 54:** Buffalo River at unmarked road, 1.5 miles south of confluence with Lake Mary Canal, 3.2 miles west of Highway 24 (T2N, R4W, Sec 24). **Station 55:** Unnamed tributary to Buffalo River at Pond Road, 0.7 mile east of Highway 24 (T1N, R4W, Sec 11). **Station 56:** Buffalo River, 1.5 miles north of Jackson Point Road, 1.9 miles west of Fort Adams (T2N, R4W, Sec 42). **Station 57:** Buffalo River, 1.0 miles north of Jackson Point Road, 1.9 miles west of Fort Adams (T2N, R5W, Sec 15). **Station 58:** Buffalo River, 0.5 mile north of Jackson Point Road, 1.9 miles west of Fort Adams (T2N, R5W, Sec 19). **Station 59:** Buffalo River, 0.5 mile south of Jackson Point Road, 1.9 miles west of Fort Adams (T2N, R4W, Sec 43). **Station 60:** Buffalo River at Mississippi River confluence, 1.5 miles southeast of Jackson Point Road, 1.9 miles west of Fort Adams (T1N, R4W, Sec 10).

FISHES OF THE TANGIPAHOA RIVER SYSTEM, MISSISSIPPI AND LOUISIANA

CHARLES L. KNIGHT
Mississippi Museum of Natural Science,
111 North Jefferson Street, Jackson, MS 39202

AND

ROBERT W. HASTINGS
Turtle Cove Environmental Research Station,
P.O. Box 585, Southeastern Louisiana University, Hammond, LA 70402

ABSTRACT

An ichthyofaunal survey of the Tangipahoa River system in the Lake Pontchartrain drainage was conducted over an 18 month period in order to compile a comprehensive list of fish inhabitants, and to compare these data with lists of species reported from other streams in the Lake Pontchartrain, lower Mississippi River, and Pearl River drainages. Eighty-five collections from 59 sites yielded 11,081 specimens including 71 species and 21 families. Over 50% of the total catch was represented by nine species of Cyprinidae followed by Centrarchidae (17%) with 14 species. *Cyprinella venusta, Lythrurus roseipinnis*, and *Gambusia affinis* were most abundant at 22.6%, 10.3%, and 9.6% of the total catch, respectively. *Lepomis macrochirus* (69.4%), *Lepomis megalotis* (64.7%), and *Gambusia affinis* (60.0%) displayed the greatest frequency of occurrence. Three species collected, *Alosa chrysochloris, Heterandria formosa*, and *Etheostoma parvipinne*, were considered new records for the Tangipahoa River system. Fishes identified during our study combined with records from other sources bring the total species reported to inhabit the Tangipahoa River system to 92. Within the Lake Pontchartrain drainage, coefficient of similarity calculations indicated that the Tickfaw, Amite, and Tchefuncte rivers supported fish assemblages most similar to the Tangipahoa, while comparisions with streams from neighboring drainage systems suggested intermediate species similarity.

INTRODUCTION

The Mississippi River is an apparent barrier for east and west dispersal of many species of freshwater fishes in the United States (Lee et al., 1980). Douglas (1974) reported 25 species of fishes occurring in Louisiana exclusively east of the Mississippi River. Two additional fishes which may be added to this list are the northern studfish (*Fundulus catenatus*) (Laiche, 1978); and the broadstripe topminnow (*Fundulus euryzonus*), a species that is endemic to the Tangipahoa and Amite rivers of the Lake Pontchartrain drainage (Suttkus and Cashner, 1981).

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Most streams in the Lake Pontchartrain drainage have had their ichthyofauna surveyed within the past 20 years (e.g., Tickfaw River, Saul, 1974; Bayou Lacombe, Sobczak, 1976, and Farabee, 1992; Amite River, Laiche, 1978; Blind River, Watson et al., 1981) (Figure 1). Prior to our study, however, no comprehensive survey had been conducted on the Tangipahoa River system. In addition to the studies conducted in the Lake Pontchartrain drainage, ichthyofaunal surveys have been made in most tributaries of the neighboring lower Mississippi River (e.g., Homochitto River, Ebert et al., 1985; Buffalo River, Cashner et al., 1976; Bayou Sara, Grady et al., 1983; Thompson Creek, Guillory, 1974, 1981, 1982) and Pearl River (e.g., Bogue Chitto River, Dosher, 1976) drainages.

Figure 1. The Lake Pontchartrain, lower Mississippi River, and Pearl River drainage in southwest Mississippi and southeast Louisiana. (1. lower Mississippi River drainage, 2. Lake Pontchartrain drainage, 3. Pearl River drainage; A. Homochitto River, B. Buffalo Bayou, C. Bayou Sara, D. Thompson Creek, E. Comite River, F. Amite River, G. Tickfaw River, H. Tangipahoa River, I. Tchefuncte River, J. Bogue Chitto River, K. Bayou Lacombe, L. Blind River).

This study was conducted to provide a comprehensive list of fish species and their relative abundances in the Tangipahoa River system, and to compare these data with those from other streams in the Lake Pontchartrain, lower Mississippi River, and Pearl River drainages in order to contribute to a greater understanding of the zoogeography of this unique area.

Study Area

The Tangipahoa River originates in Lincoln County, Mississippi, and empties into the Lake Pontchartrain estuary in Tangipahoa Parish, Louisiana. The entire watershed drains approximately 1997 sq. km (Sloss, 1977).

Elevations range from approximately 97.5 m above sea level in the upper reaches of the Tangipahoa River to sea level at the confluence with Lake Pontchartrain. Mean annual precipitation is 152.4 cm, and mean temperature is 19.4° C (Newton, 1972).

Historically, the upper basin was dominated by longleaf pine (*Pinus palustris*) (Brown, 1945). Recently, however, most of the longleaf pine forests have been replaced by loblolly pine (*Pinus taeda*), a tree planted extensively by the logging industry (Louisiana Department of Natural Resources, 1974). The lower 15 km of the river is deep and sluggish as it enters bald cypress (*Taxodium distichum*) and tupelo gum (*Nyssa aquatica*) swamps bordering Lake Pontchartrain.

The stream bed is characterized by areas of sand and sand mixed with gravel in the upper to mid reaches, and primarily sandy clay and silt downstream. Common aquatic macrophytes in this stream include eelgrass (*Vallisneria americana*), various water lilies (*Nymphaea* spp.), water milfoil (*Myriophylum spicatum*), and bushy-pondweed (*Najas guadalupensis*).

The Tangipahoa River is used for swimming, fishing, and canoeing. Lake Tangipahoa, a 283 ha man-made lake in Percy Quin State Park, interrupts the river near its headwaters in Pike County, Mississippi. The Louisiana Department of Wildlife and Fisheries (LDWF) classifies the Tangipahoa as a "natural and scenic" river (LDWF, 1981).

Materials and Methods

Most collections were taken by a combination of a Coffelt BP-lC backpack electro-shocker and 0.65 cm mesh minnow seine. In areas too deep for these methods to be effective, gill nets of varying mesh sizes were used.

Upon capture, specimens were fixed in 10% formalin for one week, soaked in water for one day, and then transferred to 40% isopropyl alcohol for identification and storage in the Southeastern Louisiana University Museum. Identification was based on Cook (1959), Douglas (1974), Parker et al. (1972), and Pflieger (1975). Nomenclature followed Robins et al. (1991). Collection records made prior to this study, from the Mississippi Museum of Natural Science, Southeastern Louisiana University Museum, and University of New Orleans Museum, were examined for additional species.

Fifty-nine sites were sampled between 1 July 1985 and 15 December 1986, and included 85 collections. Most sites were selected for accessibility and diversity of habitat and were usually at bridge crossings of highways or backroads. Care was taken to include the mainstream, all major tributaries, and all stream orders. Six stream orders were recognized using 15′ United States Geological

Survey topographical maps, according to the method described by Horton (1945), and modified by Strahler (1954, 1957). Jaccard Coefficient of Similarity (Southwood, 1966) was calculated as a correlation of species similarity between the Tangipahoa River and other rivers in the Lake Pontchartrain, lower Mississippi River, and Pearl River drainages.

Results and Discussion

A total of 11,081 fishes was collected during this study and included 71 species and 21 families. Blacktail shiners (*Cyprinella venusta*) occurred in the greatest numbers at 2511 individuals, and 22.7% of the total catch. The cherryfin shiner (*Lythrurus roseipinnis*) and mosquitofish (*Gambusia affinis*) followed at 1136 (10.3%) and 1062 (9.6%), respectively. Bluegill (*Lepomis macrochirus*), most frequently encountered in different collections, were observed 59 times at 69.4% frequency of occurrence. Longear sunfish (*Lepomis megalotis*) were found in 55 collections (64.7%) while mosquitofish (*G. affinis*) were caught on 51 occasions (60.0%).

Families represented by the greatest number of individuals were Cyprinidae at 53.4% and Centrarchidae at 17.1% of the total catch. Families from which the most species were collected were Centrarchidae with 14, and Cyprinidae and Percidae each with 9 species. Approximately 94% of the total catch consisted of six families (Cyprinidae, Centrarchidae, Poeciliidae, Percidae, Cyprinodontidae, and Catostomidae).

Species number generally increased in stream orders 1 through 5, with 25, 39, 48, 48, and 54 species collected, respectively. In the sixth order reach where sampling efforts proved less effective, 42 species were collected. Large numbers of banded pygmy sunfish (*Elassoma zonatum*) were almost entirely restricted to first order streams. Other fishes that tended to be more common in lower stream orders were the creek chubsucker (*Erimyzon oblongus*) and green sunfish (*Lepomis cyanellus*). Fishes showing a preference for the higher stream orders included the bullhead minnow (*Pimephales vigilax*), inland silverside (*Labidesthes sicculus*), mimic shiner (*Notropis volucellus*), threadfin shad (*Dorosoma petenense*), and clear chub (*Notropis winchelli*).

Three fishes collected in this study and seven species represented by specimens in the Southeastern Louisiana University museum collections had not been previously reported from the Tangipahoa River. The skipjack herring (*Alosa chrysochloris*), was captured at two locations in the main river channel in Louisiana, least killifish (*Heterandria formosa*), in a small pool near Hammond, Louisiana, and goldstripe darter (*Etheostoma parvipinne*) near the headwaters of Terry's Creek in Mississippi. None of these were new records for the Lake Pontchartrain drainage, although the goldstripe darter appears to be rare in this region.

Fishes not previously documented from this system but located in museum collections were the blue catfish (*Ictalurus furcatus*), lake chubsucker (*Erimyzon sucetta*), gulf killifish (*Fundulus grandis*), rainwater killifish (*Lucania parva*), inland silverside (*Menidia beryllina*), swamp darter (*Etheostoma fusiforme*), and saddleback darter (*Percina vigil*). None of these is apparently common in the river.

Twenty-one additional species of fishes not captured during this study have been reported from the Tangipahoa River by Douglas (1974) and Davis et al. (1970). In addition, six species were reported to be distributed statewide in

Louisiana by Douglas (1974), although specific references to these fishes occurring in the Tangipahoa River were not indicated. Therefore, we have excluded these six species from this discussion. Two species, the speckled chub (*Macrhybopsis aestivalis*) and an undescribed species of *Percina* (Thompson, 1980), reported by Douglas (1974) and also found in the Southeastern Louisiana University Museum, inhabited the Tangipahoa River at one time. However, current evidence of the occurrence of these fishes could not be found during this study. They have apparently been reduced in numbers in recent times and may even be extirpated from the river. Discrepancies in the distribution of the cypress minnow (*Hybognathus hayi*), as presented by Douglas (1974), were noted by Saul (1974). Evidence of this fish occurring in the Tangipahoa River was not substantiated.

Davis et al. (1970) noted the occurrence of several fishes in the lower Tangipahoa River, which could not be documented by other sources. Three of these (Atlantic sturgeon, *Acipenser oxyrhynchus*; paddlefish, *Polyodon spathula*; and southern flounder, *Paralichthys lethostigma*) occur in Lake Pontchartrain (pers. obs.) and seem likely inhabitants of this river. Paddlefish are commonly seen by boaters on the river (pers. comm.). Three additional species (crystal darter, *Ammocrypta asprella*; redfin darter, *Etheostoma whipplei*; and freckled darter, *Percina lenticula*) occur in adjacent drainages (Pearl River and/or lower Mississippi), but have not been reported from the Lake Pontchartrain drainage by other investigators and their existence in the Tangipahoa River seems unlikely.

One specimen of striped bass (*Morone saxatilis*) was captured from the lower channel. This species had not been reported from the river since Bean (1884) mentioned collecting specimens and seeing large schools of these fish near Osyka, Mississippi (McIlwain, 1967). The number of lateral line scales (154) indicated that our specimen was not a naturally occurring fish, but instead, a member of the Atlantic coast race introduced as part of restocking efforts of the LDWF which began in 1967 (Mr. Bennie Fontenot, LDWF, pers. comm., 1986).

The Florida subspecies of the largemouth bass (*Micropterus salmoides floridanus*) is another fish which has been stocked in the Tangipahoa River. A total of 86,300 Florida largemouth bass were stocked in the river between 1981 and 1986 (Harris, 1987). All specimens of largemouth bass captured (40) were northern largemouth bass (*Micropterus salmoides salmoides*).

Changes in geological and other environmental factors have resulted in complex distribution patterns of fishes inhabiting southwestern Mississippi and southeastern Louisiana. Aspects of these patterns were discussed by Guillory and Conner (1973), Bart and Cashner (1980), and others. Certain fishes of this region such as the frecklebelly madtom (*Noturus munitus*) and the silverjaw minnow (*Notropis buccata*) reach their western distribution limits at the Pearl River. Others, such as the bluehead chub (*Nocomis leptocephalus*), however, exhibit disjunct distribution patterns. The bluehead chub is quite abundant in the Bogue Chitto River, a tributary of the Pearl River, and is also found in some lower tributaries of the Mississippi River, but does not occur in the intervening Lake Pontchartrain drainage (Douglas, 1974). Suttkus and Clemmer (1977) proposed Bayou Pierre as a historical pathway for the dispersal of fishes such as the northern studfish and bluntface shiner (*Cyprinella camura*) between the lower Mississippi River and the Pearl River systems. Similarly, varying patterns were observed within the Lake Pontchartrain drainage. For example, the emerald shiner (*Notropis atherinoides*), found throughout Mississippi and Louisiana includ-

TABLE 1. Number of species (column at left), number of species in common (in bold type), and Jaccard Coefficient of Similarity (in parentheses) among selected streams of the Lake Pontchartrain, Lower Mississippi, and Pearl River drainages. (Tang. = Tangipahoa R., Laco. = Bayou Lacombe, Tche. = Tchefuncte R., Tick. = Tickfaw R., Sara = Bayou Sara, Homo. = Homochitto R., Thom. = Thompson Creek, Bogu. = Bogue Chitto R.; LPD = Lake Pontchartrain Drainage, MRD = Lower Mississippi R. Drainage, PRD = Pearl R. Drainage).

		Amite	Laco.	Blind	Tche.	Tick.	Sara	Homo.	Thom.	Bogu.
Tang.	(92 - LPD)	**78**(.72)	**53**(.45)	**46**(.44)	**71**(.70)	**82**(.71)	**55**(.47)	**72**(.58)	**61**(.51)	**61**(.55)
Amite	(94 - LPD)		**47**(.38)	**43**(.41)	**65**(.59)	**84**(.73)	**56**(.48)	**76**(.60)	**65**(.56)	**64**(.58)
Laco.	(78 - LPD)			**48**(.55)	**48**(.43)	**60**(.49)	**42**(.37)	**45**(.32)	**44**(.36)	**34**(.27)
Blind	(57 - LPD)				**40**(.41)	**55**(.51)	**38**(.39)	**40**(.32)	**42**(.41)	**28**(.26)
Tche.	(81 - LPD)					**73**(.65)	**48**(.43)	**64**(.51)	**55**(.48)	**54**(.50).
Tick.	(105 - LPD)						**59**(.47)	**79**(.59)	**66**(.52)	**62**(.50)
Sara	(79 - LPD)							**72**(.62)	**74**(.82)	**44**(.38)
Homo.	(109 - MRD)								**77**(.64)	**63**(.50)
Thom.	(88 - MRD)									**50**(.42)
Bogu.	(80 - PRD)									

ing most of the Lake Pontchartrain drainage (Douglas, 1974), has not been reported from the Tangipahoa River.

Fish species collected in the Tangipahoa River during this study and previous studies were compared with those from Bayous Lacombe and Sara, the Tchefuncte, Tickfaw, Amite, Blind, Homochitto, Bogue Chitto rivers, and Thompson Creek (Table 1). Eighteen species, 8 of which were centrarchids, occurred in all of these stream systems. Thirty species were found in all six streams of the Lake Pontchartrain drainage. Within the Lake Pontchartrain drainage, the Tickfaw, Amite, and Tchefuncte rivers tended to support ichthyofaunal assemblages most similar to that of the Tangipahoa River. These four rivers are ecologically and physically similar (Laiche, 1978) with suitable habitats for a variety of cyprinid, centrarchid, and percid species, many of which are common to all of these rivers. Bayou Lacombe and the Blind River, however, were quite different from the Tangipahoa River. These systems are in areas of low relief with less diversity of habitat, and consequently had significantly fewer species, especially among the minnows (Cyprinidae), madtom catfishes (Ictaluridae), and darters (Percidae). They also tended to have more marine species. Comparisons with the Homochitto River, Bayou Sara, Thompson Creek, and the Bogue Chitto River suggested that these streams were intermediate in similarity to the Tangipahoa.

Literature Cited

Bart, H. L. and R. C. Cashner. 1980. New records for the northern studfish, *Fundulus catenatus*, in the lower Mississippi and Gulf coastal drainages. Southeast. Fishes Coun. Proc. 3: 1-4.

Bean, T. H. 1884. On the occurrence of the striped bass in the lower Mississippi Valley. Proc. U. S. Nat. Mus. 7: 242-244.

Brown, C. A. 1945. Louisiana Trees and Shrubs. Claitor's Publ. Div., Baton Rouge (262 pp.).

Cashner, R. C., J. S. Rogers, and M. T. Sobczak. 1976. The fishes of the Buffalo River in western Mississippi. A. S. B. Bull. 23: 48.

Cook, F. 1959. Freshwater Fishes in Mississippi. Mississippi Fish and Game Com., Jackson (239 pp.).

Davis, J. T., B. J. Fontenot, C. E. Hoenke, A. M. Williams, and J. S. Hughes. 1970. Anadromous fishes of Lake Pontchartrain and its tributaries. Louisiana Wildlife and Fish. Bull. No. 9 (63 pp.).

Douglas, N. H. 1974. Freshwater Fishes of Louisiana. Claitor's Publ. Div., Baton Rouge (433 pp.).

Dosher, L. A. 1976. Fishes of the Bogue Chitto River, south Mississippi and southeast Louisiana M. S. Thesis, Northeast Louisiana Univ. (32 pp.).

Ebert, D. J., R. M. Weill, and P. D. Hartfield. 1985. A checklist of fishes in the Homochitto River system. J. Mississippi Acad. Sci. 30: 103-110.

Farabee, M. V. 1992. Diversity, distribution, and community stability of fishes in Bayou Lacombe. M. S. Thesis, Univ. of New Orleans (80 pp.).

Grady, J. M., R. C. Cashner, and J. S. Rogers. 1983. Fishes of the Bayou Sara drainage, Louisiana and Mississippi, with discriminate functions analysis of factors influencing species distribution. Tulane Stud. Zool. Bot. 24: 83-100.

Guillory, V. 1974. Distribution and abundance of fishes in Thompson Creek and lower Mississippi R., Louisiana. M. S. Thesis, Louisiana State Univ. (79 pp.).

Guillory, V. 1981. A checklist of fishes of Thompson Creek, Louisiana with zoogeographical comments. Proc. Louisiana Acad. Sci. 44: 37-47.

Guillory, V. 1982. Longitudinal gradients of fishes in Thompson Creek, Louisiana. Southwest. Nat. 27: 70-115.

Guillory, V. and J. V. Conner. 1973. Fishes of Thompson Creek in the Feliciana Parishes of Louisiana and southwestern Mississippi. A. S. B. Bull. 20: 31.

Harris, S. A. 1987. Hopes for Bragging Size Stringer. Louisiana Cons. 39: 24-37.

Horton, A. 1945. Erosional development of streams and their drainage basins. Geol. Soc. Amer. Bull. 56: 275-370.

Laiche, G. S. 1978. The fishes of the Amite River drainage in Mississippi and Louisiana. M. S. Thesis, Univ. of New Orleans (103 pp.).

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American Freshwater Fishes. Publ. 1980-12. North Carolina Biol. Sur. (854 pp.).

Louisiana Department of Natural Resources. 1974. Louisiana forest types. Public document published under authority of R. S. 56: 31.

Louisiana Department of Wildlife and Fisheries. 1981. Louisiana's natural and scenic stream system. Public document published under authority of R. S. 43: 31.

McIlwain, T. D. 1967. Distribution of the striped bass, *Roccus saxatilis* (Walbaum) in Mississippi waters. Proc. Twenty-first Ann. Conf. Southeast. Assoc. Game Fish. Comm., pp. 254-257.

Newton, M. B., Jr. 1972. Atlas of Louisiana. Louisiana State Univ., School of Geoscience, Miscellaneous Publ. 72-1 (196 pp.).

Parker, J. C., B. J. Galloway, and D. Moore. 1972. Key to the estuarine and marine fishes of Texas. *In* J. C. Parker, ed. Texas A & M Univ. Sea Grant Publ. No. TAMU-SG-72-402 (177 pp.).

Pflieger, W. L. 1975. The Fishes of Missouri. Missouri Dept. Cons. (343 pp.).

Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. A list of common and scientific names of fishes from the United States and Canada (5th ed.). Amer. Fish. Soc. Spec. Publ. No. 20: 1-183.

Saul, G. E. 1974. Icthyofaunal investigation of the Tickfaw River drainage basin. M. S. Thesis, Louisiana State Univ. (53 pp.).

Sloss, R. 1971. Drainage area of Louisiana streams. Basin Records Report, No. 6, Louisiana Dept. Pub. Works (117 pp.).

Sobczak, M. T. 1976. Physical and chemical factors affecting the distribution and occurrence of fishes in Bayou Lacombe, Louisiana. Ph. D. Dissertation, Tulane Univ. (87 pp.).

Southwood, T. R. E. 1966. Ecological Methods. John Wiley and Sons, New York, New York (524 pp.).

Strahler, A. N. 1954. Quantitative neomorphology of erosional landscapes. Compt. Pend. Nineteenth Intern. Geol. Cong. Sec. 13: 341-354.

Strahler, A. N. 1957. Quantitative analysis of watershed geomorphology. Trans. Amer. Geoph. Union 338: 913-920.

Suttkus, R. D. and G. H. Clemmer. 1977. A status report on the bayou darter, *Etheostoma rubrum*, and the Bayou Pierre system. Southeast. Fish. Counc. Proc. 1: 1-12.

Suttkus, R. D. and R. C. Cashner. 1981. A new species of Cyprinodontid fish, genus *Fundulus* (*Zygonectes*), from the Lake Pontchartrain tributaries in Louisiana and Mississippi. Bull. Alabama Mus. Nat. Hist. 6: 1-17.

Thompson, B. A. 1980. *Percina caprodes* (Rafinesque) Logperch. *In* D. S. Lee et al., Atlas of North American Freshwater Fishes, pp. 719-720. North Caroloina State Mus. Nat. Hist. Raleigh.

Watson, M. B., C. J. Killebrew, M. H. Schartz, and J. L. Landry. 1981. A preliminary survey of the Blind River, Louisiana. Amer. Fish. Soc. Warmwater Stream Sym. pp. 303-319.

Appendix. A checklist of fishes of the Tangipahoa River, southwest Mississippi, and southeast Louisiana. (Source codes: Do = Douglas, 1974; Da = Davis et al., 1970; SLU = Southeastern Louisiana University Museum collection. Sources only provided for those species not collected during this study).

Family and Species	Source
Petromyzontidae (lampreys)	
Icthyomyzon castaneus, chestnut lamprey	
I. gagei, southern brook lamprey	
Acipenseridae (sturgeons)	
Acipenser oxyrhynchus, Atlantic sturgeon	Da
Polyodontidae (paddlefishes)	
Polyodon spathula, paddlefish	Da
Lepisosteidae (gars)	
Lepisosteus oculatus, spotted gar	
L. osseus, longnose gar	Da, SLU
L. platostomus, shortnose gar	Da, Do
L. spatula, alligator gar	
Amiidae (bowfins)	
Amia calva, bowfin	
Anguillidae (freshwater eels)	
Anguilla rostrata, American eel	Do
Clupeidae (herrings)	
Alosa alabamae, Alabama shad	
A. chrysochloris, skipjack herring	
Dorosoma cepedianum, gizzard shad	
D. petenense, threadfin shad	
Engraulidae (anchovies)	
Anchoa mitchilli, bay anchovy	
Cyprinidae (carps and minnows)	
Cyprinella venusta, blacktail shiner	
Hybognathus hayi, cypress minnow	Do
Luxilus chrysocephalus, striped shiner	
Lythrurus fumeus, ribbon shiner	Do
L. roseipinnis, cherryfin shiner	
Macrhybopsis aestivalis, speckled chub	Do, SLU
Notemigonus crysoleucas, golden shiner	
Notropis longirostris, longnose shiner	
N. texanus, weed shiner	
N. volucellus, mimic shiner	
N. winchelli, clear chub	
Opsopoeodus emiliae, pugnose minnow	
Pimephales vigilax, bullhead minnow	
Catostomidae (suckers)	
Erimyzon oblongus, creek chubsucker	
E. sucetta, lake chubsucker	Do, SLU
E. tenuis, sharpfin chubsucker	
Hypentelium nigricans, northern hog sucker	
Ictiobus bubalus, smallmouth buffalo	Do, Da
Minytrema melanops, spotted sucker	
Moxostoma poecilurum, blacktail redhorse	
Ictaluridae (bullhead catfishes)	
Ameiurus melas, black bullhead	
A. natalis, yellow bullhead	
Ictalurus furcatus, blue catfish	SLU
I. punctatus, channel catfish	
Noturus gyrinus, tadpole madtom	
N. leptacanthus, speckled madtom	
N. miurus, brindled madtom	
N. nocturnus, freckled madtom	
Pylodictis olivaris, flathead catfish	

APPENDIX. (Continued)

Family and Species	Source
Esocidae (pikes)	
Esox americanus, grass pickerel	
E. niger, chain pickerel	
Aphredoderidae (pirate perches)	
Aphredoderus sayanus, pirate perch	
Cyprinodontidae (killifishes)	
Fundulus chrysotus, golden topminnow	
F. euryzonus, broadstripe topminnow	
F. grandis, gulf killifish	SLU
F. notti, bayou topminnow	
F. olivaceus, blackspotted topminnow	
Lucania parva, rainwater killifish	SLU
Poeciliidae (livebearers)	
Gambusia affinis, mosquitofish	
Heterandria formosa, least killifish	
Atherinidae (silversides)	
Labidesthes sicculus, brook silverside	
Menidia beryllina, inland silverside	SLU
Percichthyidae (temperate basses)	
Morone mississippiensis, yellow bass	
M. saxatilis, striped bass	
Centrarchidae (sunfishes)	
Ambloplites ariommus, shadow bass	
Centrarchus macropterus, flier	
Elassoma zonatum, banded pigmy sunfish	
Lepomis cyanellus, green sunfish	
L. gulosus, warmouth	
L. macrochirus, bluegill	
L. marginatus, dollar sunfish	
L. megalotis, longear sunfish	
L. microlophus, redear sunfish	
L. punctatus, spotted sunfish	
Micropterus punctulatus, spotted bass	
M. salmoides, largemouth bass	
Pomoxis annularis, white crappie	
P. nigromaculatus, black crappie	
Percidae (perches)	
Ammocrypta asprella, crystal darter	Da
A. beani, naked sand darter	
Etheostoma chlorosomum, bluntnose darter	
E. fusiforme, swamp darter	SLU
E. parvipinne, goldstripe darter	
E. proeliare, cypress darter	
E. stigmaeum, speckled darter	
E. swaini, gulf darter	
E. lynceum, brighteye darter	
E. whipplei, redfin darter	Da
Percina caprodes, logperch	Do, SLU
P. lenticula, freckled darter	Da
P. nigrofasciata, blackbanded darter	
P. sciera, dusky darter	
P. vigil, saddleback darter	SLU
Sciaenidae (drums)	
Aplodinotus grunniens, freshwater drum	
Mugilidae (mullets)	
Mugil cephalus, striped mullet	
Bothidae (flounders)	
Paralichthyes lethostigma, southern flounder	Da
Soleidae (soles)	
Trinectes maculatus, hogchoker	

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